FEBRUARY 2019

CODE ENFORCEMENT BASICS

RETHINK CONSISTENCY MEETINGS

A LARGE PART OF A CODE OFFICIAL'S JOB IS PROVIDING EDUCATION TO THE PUBLIC AND RESPONDING TO INQUIRIES ABOUT CODES.

IN PROVIDING THE BEST SERVICE TO THE PUBLIC, THE CODE OFFICIAL NEEDS TO BE ACCURATE AT ALL TIMES.

GOALS

IMPROVE ATTENDANCE
Maintain and increase attendance.

IMPROVE PARTICIPATION
Share ideas. Encourage participation and engagement.

IMPROVE CONTENT
Refresh old requirements and learn new ones.

TALENT DEVELOPMENT
Builders may send younger or specialized staff. Some residential CO's will have an opportunity to present. (Pilot program)

CODE ACADEMY

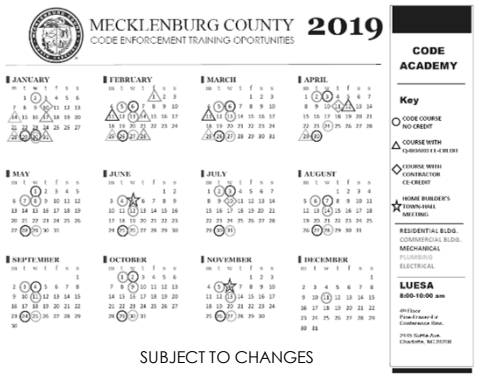
(A LEARNING AND PROFESSIONAL DEVELOPMENT PROGRAM DESIGNED FOR CODE OFFICIALS, AND OPEN TO THE INDUSTRY)

IMPROVE ATTENDANCE

NEW CALENDAR!

Allows you to plan ahead and attend crucial meetings and to skip the ones that are less pertinent.

IMPROVE ATTENDANCE



SUBJECT TO CHANGES

Calendar: Mecklenburg County Code Academy Training Opportunities

IMPROVE PARTICIPATION

INTERACTIVE PRESENTATIONS

Continue encouraging participation.

Share ideas and learning from each other.

Invite guest speakers.

IMPROVE CONTENT

SINGLE TOPIC FORMAT:

Refresh code basics, see code changes, technical issues, permit issues and inspection issues all in one meeting

IMPROVE CONTENT

2019 CALENDAR - NEW MEETING FORMATI

DATE	SUBJECT	DESCRIPTION
2/6/19	Code Enforcement Basics	Code Administration, Plan Review, and Inspections.
3/6/19	Structural Design	Climatic and geographical design criteria; prescriptive and performance design; basic loads, wind, snow, seismic and flood loads.
	Site Development	Site development, location on property, fire separation distance, soils and fills, site preparation, footings, foundations, rebar inspections and storm drainage.
4/3/19	Framing & Bracing	Grade marks, engineered wood products, trusses, wood treatment, cutting boring and notching, fireblocking and draftstopping, floors, decks, walls, ceiling and roof framing and bracing.
	Townhome Design	Townhome design, area separation walls, products, firestopping, R315 and design pitfalls.
5/1/19	Fire Safety	Residential sprinkler, smoke alarms, fire resistance, dwelling separation, floor fire protection, foam plastic, chimneys and fireplaces.
	Decks	Construction requirements and accumumation, common deck failures, fasteners, hanger hardware, ledger connections, guard rail and guard post attachments, footers, beams, columns, stairways, and pressure treated wood concerns. AWC4DCA6.
6/5/19	**Town Hall**	Town-Hall style meeting with home builders to give updates, discuss code changes, interpretations and any other issues.
7/3/19	Home Safety	Room areas; ceiling height; fall protection; safety glass; means of egress, emergency escape and rescue openings.
	Home Health	Natural and artificial light, ventilation, CO2 alarms, heating and cooling, sanitation.
	Other Hazards	Termite protection, swimming pools, hot tubs, radon control, lead and asbestos.
8/7/19	Finishes	Interior finishes, exterior wall coverings, roof coverings, weather protection and masonry design.
	MEP Basics	Plumbing mechanical, electrical design basics
9/4/19	ACCELA	Instructions on how to use the new Accela System. ACCELA is a computer platform that allows builders to easily submit permit applications, make payments, check status, schedule inspections, and upload information, all from their PC or tablet, 24/7. This is a faster way to request and process permits and ensures builders can get the latest status of their permits and better manage their projects.
10/2/19	Energy	Energy conservation, climate zone, insulation, windows and doors, air leakage, systems, energy certificates and ERI.
	Other Buildings	Overview of green buildings, child and adult care facilities, permanent modular, tiny homes, manufactured housing, container units and piers and docks.
11/6/19	**Town Hall**	Town-Hall style meeting with home builders to give updates, discuss code changes, interpretations and any other issues.

Subject to changes

TALENT DEVELOPMENT

CO's

Some CO's will have an opportunity to present. (Pilot program)

BUILDERS:

Opportunity to train younger or specialized staff.

KEY TO SUCCESS.

What's key for the program be successful?

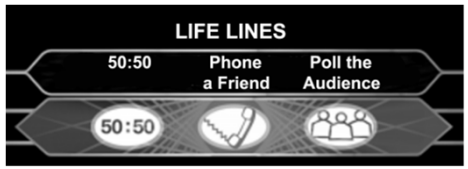
KEY TO SUCCESS.

10 %

The average amount of information that people retain from a presentation

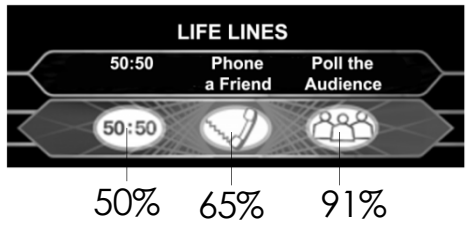
KEY TO SUCCESS.

What do you typically do when you have difficult code question?



KEY TO SUCCESS.

Probability of having the correct answer



KEY TO SUCCESS.

Communicate with and trust your TEAM!

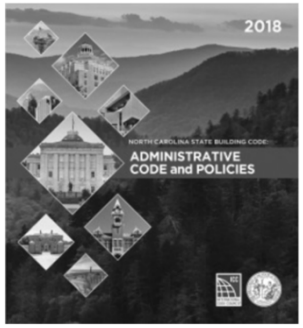
CODE ENFORCEMENT BASICS

EURILYNN CARABALLO-LUCCIONI, AIA

ASSOC. RESIDENTIAL BUILDING CODE ADMINISTRATOR

CODE ADMINISTRATION

Code administration is regulated by…



They define the ground rules.

- The scope.
- Types of work.
- Authority of the building official.

Who is the building official?

The officer appointed by the jurisdiction as stated on the NC general statutes. He or she is charged with the administrative responsibilities of the building department. (204.1,204.2).

Responsibilities of the Building Official.

Under the general supervision and in cooperation with

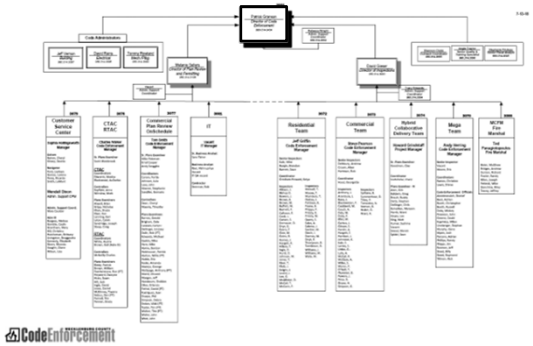
- NCDOI in respect to code provisions

- DOL in respect to elevators, boilers, etc. (GS 160A, GS143) (Not applicable for RES.)

Who is the building official?

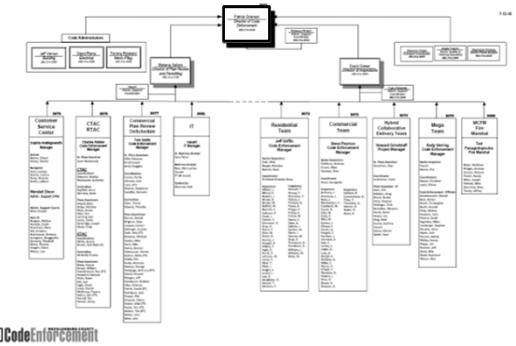
In Mecklenburg County we identify the building official as the **"Director of Code Enforcement".**

Who is the building official?



The Building Official delegates authority to:

- **Code Administrators**
- **Plan reviewers**
- **Inspectors**



Who is the C.A.?

In Mecklenburg County the Director of Code Enforcement has authorized the Code Administrators to make official interpretations of the code.

INTERPRETATION

The B.O. Is responsible for:

Developing policies and procedures to support the consistent application of the code.

IN REALITY…

Building Official , Plans Examiners & Inspectors are interchangeable terms. They <u>all</u> represent the department.

KEY CONCEPTS

- Intent
- Interpretation
- Alternates

INTENT

To set <u>minimum</u> requirements to protect the health, safety and welfare of the public

INTENT

How Codes define the minimum?

INTENT

Through risk assessment and consensus

INTENT

Is workmanship in the code?

INTENT

Workmanship is not within the purview of the code.

The Code is the lowest quality construction allowed by law.

INTENT

Can the B.O. ask for more than the code requires?

INTENT

Asking more than the code requires is :

- **Is illegal**
- **Undermines Credibility**

THIS WEEK ON THE NEWS

Pulling back the curtain on LA's third-party home building inspectors

A judge in the civil suit involving Mohamed Hadid ordered the city to release names of 2 of these so-called deputy inspectors

By Natalie Heberman | January 23, 2019 10:30AM

INTENT

Who has the authority to make code interpretations?

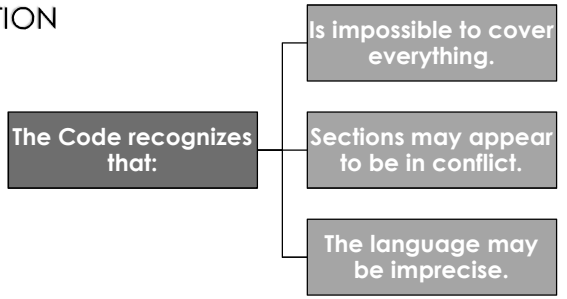
INTERPRETATION

The Code gives authority to the building official to make interpretations as to the correct application of the provisions

in keeping with the intent and purpose of the code.

INTERPRETATION **Why we need interpretations?**

INTERPRETATION



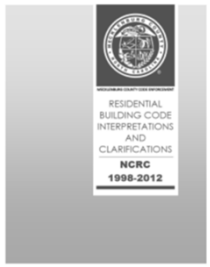
INTERPRETATION **How many local interpretations Mecklenburg has?**

INTERPRETATION

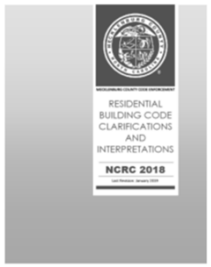
Not many.

We need to start differentiating clarifications from interpretations.

INTERPRETATION



https://www.mecknc.gov/LUESA/CodeEnforcement/Tools/CodeInterpretations/Pages/ResidentialInterpretations.aspx



Soon to be released.
Under final review.

INTERPRETATION

When in doubt, shouldn't we err on the side of safety?

INTERPRETATION

NO!

The building official must restrict all decisions to the intent and purpose of the code.

INTERPRETATION

When in doubt, does the most restrictive requirement apply?

NO!

INTERPRETATION **The more <u>specific</u> requirement applies.**

INTERPRETATION **Can inspectors or plans examiner make code interpretations?**

INTERPRETATION **Yes….To a degree.**

INTERPRETATION Experienced inspectors, plan reviewers and other technical staff are given some degree of authority to act for the building official in the decision-making process, including the making of appropriate interpretations on various provisions of the code.

INTERPRETATION

Building Officials need to learn to recognize the flexibility of the code.

INTERPRETATION

The NCRC has less flexibility than the NCBC because it is prescriptive for the most parts and very heavily redacted.

INTERPRETATION

Reviewers and inspectors must be comfortable and confident in their decisions.

INTERPRETATION

When they are not, they must do **additional research and consult with their teams and supervisors.**

INTERPRETATION

Issues that are not directly addressed or that are unclear in the code should be interpreted by the CA.

INTERPRETATION

The basis for such determination often takes some research to discover.

INTERPRETATION

Can requirements be waived by the Building Official?

INTERPRETATION

Waiving requirements is against the law.

APPEALS

Who has the authority to grant modifications of the code?

APPEALS

The Building Code Council.

For individual cases where the strict letter of the code is impractical, and the modification does **not lessen the intent of the code**. (103.5)

APPEALS

Who is in the Building Code Council?

APPEALS

17 members

Architects, engineers, contractors, inspectors, and government officials and others.

They responsible of adopting and revising the code and make recommendations, regarding administration and legislation. (202.2) (GS143-148).

APPEALS

Who makes final decisions?

APPEALS

The Building Official makes final decisions.

Many sources are typically consulted before making and interpretation.

INTERPRETATION

In Mecklenburg County…

The Building Official has extended the authority to make official code interpretations to the Code Administrator

INTERPRETATION

NCDOI Also provides interpretations:

- **Formal**
- **Informal.**

INTERPRETATION

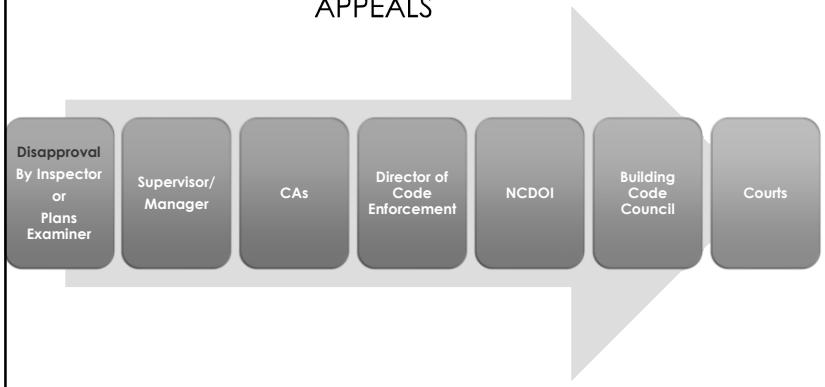
NCDOI

NCDOI can issue a formal interpretation and overrule a local interpretation if an appeal is requested.

APPEALS

How can someone appeal an interpretation?

APPEALS



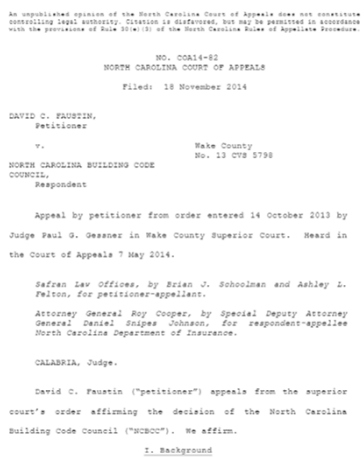
APPEALS

Local News

Despite concerns over 'high-wind areas,' construction lobbyist wins appeal over house inspections

By Benjamin Schachtman - November 30, 2010

COURTS



An unpublished opinion of the North Carolina Court of Appeals does not constitute controlling legal authority. Citation is disfavored, but may be permitted in accordance with the provisions of Rule 30(e)(3) of the North Carolina Rules of Appellate Procedure.

NO. COA14-82
NORTH CAROLINA COURT OF APPEALS

Filed: 18 November 2014

DAVID C. FAUSTIN,
Petitioner

v. Wake County
No. 13 CVS 5798

NORTH CAROLINA BUILDING CODE COUNCIL,
Respondent

Appeal by petitioner from order entered 14 October 2013 by Judge Paul G. Gessner in Wake County Superior Court. Heard in the Court of Appeals 7 May 2014.

Safran Law Offices, by Brian J. Schoolman and Ashley L. Felton, for petitioner-appellant.

Attorney General Roy Cooper, by Special Deputy Attorney General Daniel Snipes Johnson, for respondent-appellee North Carolina Department of Insurance.

CALABRIA, Judge.

David C. Faustin ("petitioner") appeals from the superior court's order affirming the decision of the North Carolina Building Code Council ("NCBCC"). We affirm.

I. Background

ALTERNATES

Can we approve something that is not in the code?

AMMRS

YES!

The code lets you use AMMRs.

AMMRS

One of the most important provisions in the administrative code. (105.1)

AMMRS

The intent is to implement the adoption of new technologies and to encourage state-of-the-art concepts in construction if they meet the performance level intended by the NCRC.

AMMRS

The alternative must be equal in quality, strength, effectiveness, fire resistance, durability, safety. (i.e. recycled materials).

Tests or analysis may be required. (105.2) Where tests are performed, reports must be retained by the building official.

ALTERNATES

AMMRs Disapproval

The reason for disapproval must be in writing.

ESRs

Reports issued by the ICC Evaluation Service (ICC-ES) are valuable resources in verifying performance equal to the code requirements.

ALTERNATES

AMMRs Review Fees

NOT FREE! $145 per hour.

ALTERNATES

What is the difference between EJs and AMMRs?

ALTERNATES

EJs are normally unexpected and field driven.

AMMRs are normally planned.

APPLICABILITY

When do the provisions of the appendices apply?

APPLICABILITY

When specifically adopted. (R102.5). Appendices NOT adopted may be still be useful when evaluating AMMRs (101.3.4).

APPLICABILITY

What building code requirement the NCRC does not address?

Accessibility (101.3.2.2)

APPLICABILITY

Existing Buildings:

Existing buildings are permitted to continue to be used without change and to be maintained per code under which they were constructed.

APPLICABILITY

Existing Buildings:

- Only new work shall comply with current building codes.

APPLICABILITY

Existing Buildings:

***Any portion of a building that creates a hazard or unsafe condition, the code enforcement official shall determine to how that portions are to be upgraded to conform to the NCEC or the technical codes. (101.3.6, R102.7.1).**

APPLICABILITY

Existing Buildings:

NCEBC offers compliance alternatives for construction on existing buildings .

APPLICABILITY

Work may be categorized as:

1. Repair
2. Renovation
3. Alteration
4. Reconstruction.

APPLICABILITY

Other laws:

The provisions of the code shall not be applied in a manner that conflicts with local, state or federal law.

APPLICABILITY

Reference standards:

They shall be considered part of the requirements of the code, to the prescribed extent of each such reference. Where differences occur between provisions of the construction codes and referenced codes and standards, the provisions of the construction codes shall apply.

APPLICABILITY

Examples of reference standards:

ACI 318
Structural concrete.

UL127-2011
Factory built fireplaces.

PLAN REVIEW

PLAN REVIEW

Why do we need plan review?

PLAN REVIEW

1. Costs to escalate very rapidly in the field.

Field issues, can put people <u>out of business</u>.

PLAN REVIEW

2. NC Amendments

Because the NC code is so heavily amended, plan review is **essential** to alert customers of deficiencies and to guide them though the complexities of our code.

PLAN REVIEW

3. Coordinate other requirements.

-Plan review is important to go over critical issues such as structural safety, zoning, natural hazards (flood, wind, etc.) **BEFORE** the work has begun.

-Plan review fees pay for enforcement.
-Review is not required for one- and two-family dwelling plans. (106.2.3)

PERMITS

WORK EXEMPT

Is work exempted from a permit required to comply with the provisions of the code?

WORK EXEMPT

Even if a permit is not required, ALL work must follow the code.

WORK EXEMPT

Example…

An accessory building in a flood zone, is required to be above the flood level.

PERMITS

When are permits required?

WORK EXEMPT

Accessory buildings, fences, small retaining walls, sidewalks and driveways, and **many others** are exempt.

WHEN IN DOUBT , **REVIEW STATUTES.**

WORK EXEMPT

Example:

A farm building (plant nursery) that is both commercial and open to the building. Is <u>not</u> exempt.

INSPECTIONS

INSPECTIONS

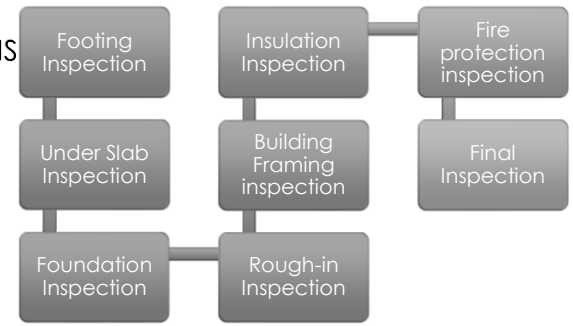
Why do we need inspections?

01	02	03	04
Ensure that everything is built to the plans, including construction and materials	Minor discrepancies are allowed.	Ensures that everything is built to minimum standards and with the appropriate materials.	Protects the builder and the owner against future litigation.

REQUIRED INSPECTIONS

What types of inspections are specifically required by code? When are inspections required?

REQUIRED INSPECTIONS



WORK MUST BE VISIBLE

The permit holder is responsible to make the work accessible, available and visible for inspections, the **work shall not be concealed** until authorized by the inspector.

VOLUNTARY INSPECTIONS

Sometimes the easiest way to do this is by requesting a voluntary additional inspection.

(i.e. courtesy inspection, sheathing inspection, etc.). The request must arise from the permit holder.

SUCCESSIVE INSPECTIONS

Each successive inspection must be approved prior to further work. (107.3)

SUCCESSIVE INSPECTIONS

If phased construction is necessary, it shall be discussed with the inspector at a pre-con meeting or during plan review.

DOCUMENTS

For how long the approved construction documents and inspection reports shall be retained by MCCE?

In Meck Co. permits are kept on file for six years from the final c/o date. (this is the max. time required by law)

ACCESS

Whose duty is to provide access to work in need of inspection?

The person requesting the inspection.
The inspector has the right to enter the premises (201.2.6).

COS

What information shall be included in the CO?

Name and address of the owner
Building Official
The code edition

ACCESS

A temporary CO is valid for how long?

A period set by the building official. The suggested timeframe is 60 days. The maximum is 180 days. There can't be any life-safety issues.

REVOKE

What are valid reasons to revoke a permit?

REVOKE

- The permit was issued by error
- It was issued in violation of a jurisdictional ordinance.
- Inaccurate information was provided at the time of issuance.

TEMPORARY PERMITS

How long is a temporary permit valid for?

180 days.

REVOKE

Which conditions or circumstances would bring the validity of the permit into question?

Misrepresentation of application.

Violation of code provisions

STOP WORK ORDER

When should a stop work order be issued?

When the building is deemed unsafe. (204.2.7)
It shall be issued to the person doing the work or the owner.
GS 160A-421.

EXPIRATION

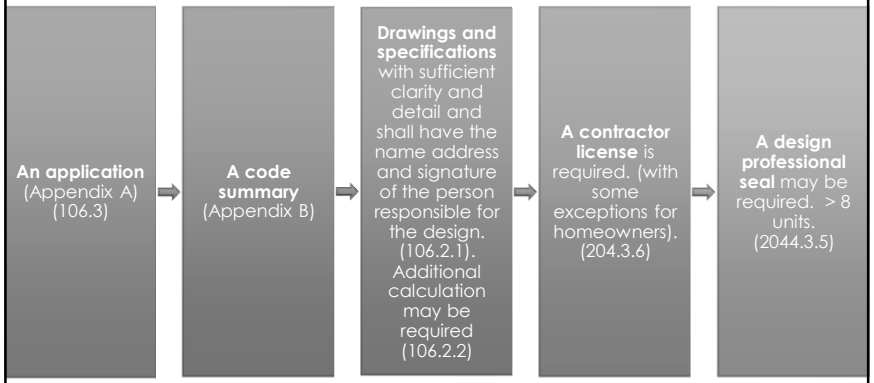
When does a permit expire? What must occur when a permit expires prior to completion of a building?

-180 days.

-If the work is discontinued for 12 months the permit immediately expires.

SUBMITTALS

What submittal documents must be provided with each permit application? Under what conditions are submittal documents not required?



RDP

What is the role of a design professional in responsible charge? When is such an individual to be utilized?

RDP

Plans and specifications sealed by a licensed architect or registered engineer are required for any new building, building addition or alteration to an existing building, with the exception of one or two-family dwellings. Plans are reviewed within the department and by other City and County agencies as required. One or two-family dwellings may also use a registered design professional for AMMRs.

DEFERRED SUBMITTALS

What is a deferred submittal? What is the process for deferring the submittal of construction documents?

Those portions of the design that are not submitted at the time of the permit application and that are to be submitted to the building official within a specified period.

SHOP DRAWINGS AND CDS

What information is required on the construction documents? What special requirements shop drawings, means of egress layouts and exterior wall envelopes?

The work shall not deviate substantially from the permit documents. (204.3.3)

DEFERRED SUBMITTALS

The RDP or applicant, shall list the deferred submittals on the construction documents for review by the building official.

DEFERRED SUBMITTALS

Any changes to the originally approved drawings because of a deferred submittal shall be submitted to the county for review as a revision to the approved drawings. If this is done, outline the changes being made to the drawings, cloud changes on the drawings, and submit revised drawing sheets for review.

DEFERRED SUBMITTALS

Shop drawings shall be submitted to the RDP who shall review them, approve them, and then forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building.

3RD PARTY INSPECTIONS

The building official shall conduct all required inspections or have authority to accept reports of inspection by approved agencies or individuals.

INSPECTIONS RECORDS

Reports of such inspections shall be in writing and be certified by an officer of an approved agency or by an approved individual.

IDENTIFICATION

The building official shall carry proper identification when inspecting structures or premises in the performance of duties under the construction codes.

RIGHT OF ENTRY

The inspector has right of entry where it is necessary to make an inspection to enforce the provisions of the construction codes

RIGHT OF ENTRY

Where the building official has reasonable cause to believe that there exists in a structure or upon a premises a condition which is contrary to or in violation of the construction codes which makes the structure or premises unsafe, dangerous or hazardous.

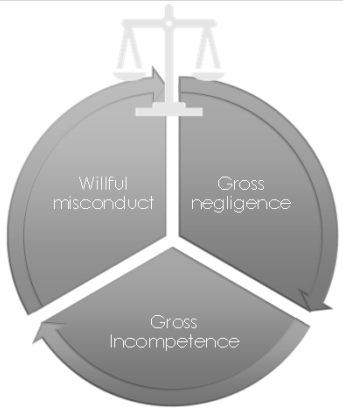
RIGHT OF ENTRY

The building official is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by the construction codes, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested.

RIGHT OF ENTRY

If entry is refused, the building official shall have recourse to the remedies provided by law to secure entry.

LIABILITY



LIABILITY

- Accepting bribes
- Accepting money or gifts
- Harassment
- Promoting side business
- Using company time and resources for personal business
- Goofing off on company time
- Signing for inspections not done
- Stealing
- Discrimination
- Falsification of records
- Misrepresenting credentials

LIABILITY

Code Officials must be able to identify potential conflicts of interest and to remove themselves to avoid the appearance of impropriety.

APPROVED MATERIALS AND EQUIPMENT

Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

USED MATERIALS AND EQUIPMENT

Used materials, equipment and devices shall not be reused unless approved by the building official.

ORDINARY REPAIRS

Shall not include:

Cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements;

ORDINARY REPAIRS

Shall not include:

Addition to, alteration of, replacement or relocation of any water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

VALIDITY OF PERMIT	The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data

EXPIRATION	The building official is authorized to grant, in writing, one extension of time,

EXPIRATION	The extension shall be requested in writing prior to expiration and justifiable cause demonstrated

PERMIT ON SITE	Until the completion of the project

QUESTIONS ?



01 PRESCRIPTIVE

By the book.
(Just tell me what to do!)

02 PERFORMANCE

Computer Model & Report

03 TOTAL U-VALUE ANALYSIS

Manual
~~REScheck~~
Other software

04 ENERGY RATING INDEX

HERS Index

ENERGY CODE COMPLIANCE PATHS
WHICH ONE WILL WORK BEST FOR YOUR PROJECT?

ERI CODE COMPLIANCE PROCESS

PERMITING AND PLAN REVIEW

- The builder submits the projected rating with the permit application.
- MCCE plans examiner verifies the RDP or HERS rater is certified with RESNET.

INSPECTION

- Approved 3rd party conducts inspection prior to the insulation inspection, leaves checklist on site. (preferably located by the window).
- MCEE inspector reviews the checklist and verifies that the mandatory code requirements are met.

FINAL

- The builder uploads the "confirmed" ERI certificate and results from the door leakage and blower door tests.
- MCCE Inspector reviews and confirms that all documents passed.

FIRE BLOCK VS. FIRE STOP

Fire Block OK as long as it doesn't touch the Shaft Wall or the required airspace.

Fire Stop OK but not required. It is only required if going through, or touching the shaft wall or airspace.

Thank you.

MARCH 6TH, 2019
8:00 -10:00 AM

STRUCTURAL DESIGN: Climatic and geographical design criteria, prescriptive and performance design, basic loads, wind, snow, seismic and flood loads.

SITE DEVELOPMENT: Site development, location on property, fire separation distance, soils and fills, site preparation, footings, foundations, rebar inspections and storm drainage.

March 2019

Structural Design

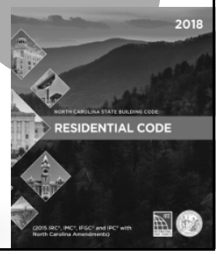
What is structural design anyway?

- More than crunching numbers.
- Maintaining the balance, between safety, cost and durability.

Conventional Design vs. Engineered Design

Conventional Design

- Is prescriptive. Set by the **NCRC**.
  - Span tables
  - Pre-defined details
  - Pre-defined options



Conventional Design - Code Alternatives

- WFCM Wood Frame Construction Manual
- AISI S230 (Cold Formed Steel)
- ICC 400 (Log Homes)
- AAMA/NPEA/NSA 2100. (Sunrooms) ***Code Change**

Conventional Design

- **Most used method in single family homes.**
  - 90% of MCCEs residential projects are single family homes.
- **Easy for builders & inspectors**
  - NO RDP required

Engineered Design

- The design is not constrained to fit within the limitations of prescriptive design.
- Conventional details can still be used where they are applicable.

Engineered Design

Is required when using…

- Long spans
- High Hazards (wind, flood, seismic)
- Unconventional Products
- Bad soils
- High end features, atriums, high-tech appliances, etc.

Engineered Design

Is required when using…

- Foundation walls exceeding 48" of unbalanced fill with no lateral support at the bottom or with hydrostatic pressure. (code change)
- Walls exceeding the max. story height.
  - Wood frame & SIP 11'-7"
  - Masonry 13'-7".

In either case…

The Design Team **MUST** know and follow:

- Code requirements
- Amendments
- Referenced standards
- Local Interpretations

Other Important Referenced Standards:

- ***Wood Frame Construction Manual*** (AWC) (R301.1.1)
- **NDS -***National Design Specifications for Wood Construction* (AWC)
- **ACI-318** - *Building Code Requirements for Structural Concrete* (ACI)
- **ACI-530** - *Building Code Requirements for Masonry Structures* (ACI)
- **ASCE 7-10** - *Minimum Design Loads for Buildings and Other Structures* (ASCE)

When reviewing structural drawings…

- Must show 100% construction documents.
- Structural notes take precedence over specifications. (exception to the norm)
- Plans should always have dimensions.

Basic Concepts

CH. 3

Structural Criteria

- Based on climate and geographical location.
- Wind, seismic, flood **AND** other environmental hazards such as roof ice dams and termites.

Construction Methods

- Platform
- Balloon Framing

Platform Framing

- The most common method in modern construction.

Balloon Framing

- Found in historical homes
- Sometimes used in portions of homes for added rigidity (great rooms, stairwells, gable-end walls, etc.)

System Performance

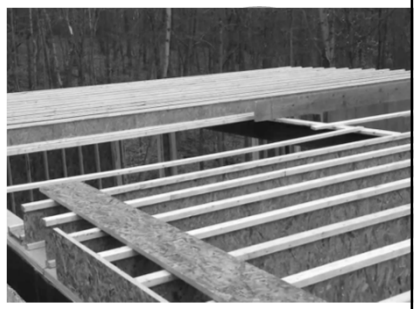
- Structural members **do not** work independently in light-frame construction. They are always part of a SYSTEM.

System Performance

- Two basic principles in system performance are:
  - **Load Sharing**
  - **Composite Action**
- Members in light frame construction often work in both ways.

Load Sharing

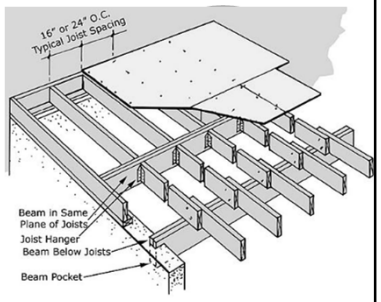
The strength comes from: **multiple elements sharing the load**.



Composite Action

The strength comes from: **the manner that the elements come together.**

(glue, nails, joist spacing, grain direction, staggered joints, etc.)



Whole House Testing

- **Whole House Testing** is becoming a crucial component in the development of many building products.
- It shows that the strength comes from the way the building is put together as a SYSTEM.
- The building is only as strong as its weakest link.

Whole house testing

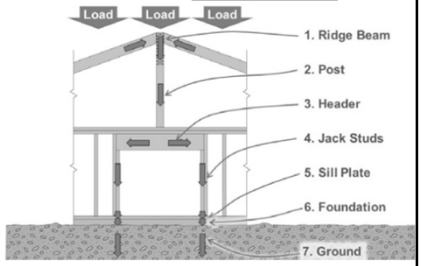
Two examples of composite action

Earthquake Test
Log Home

Wind (130 mph)
Hurricane straps vs. no straps.

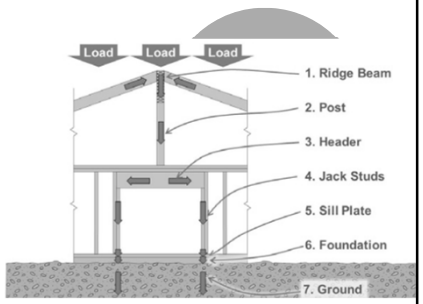
Load Path Analysis

- Used to minimize the material needed in the load-bearing member to support the design load.



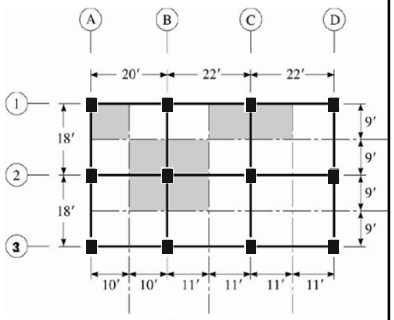
Load Path Analysis

- Load paths can be very complex, but the load path must be understood to determine tributary areas.

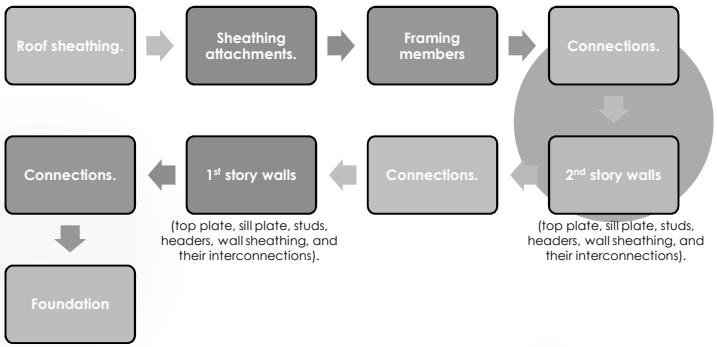


Tributary Area

- Is the portion of the load assigned to each member.



Vertical Load Path Sequence



Deflection

- The code sets limits on the maximum allowable deflection depending on the type of member involved.

Deflection

- Greater deflection is allowed in ceiling joists and rafters than in floor joists.
- Code Changes: Table R301.7 Deflection also applies to ceilings and exterior walls - wind loads.

Exposure Categories

- Important when applying the provisions for wall sheathing, wood wall bracing, roof uplift resistance, and exterior wall and roof coverings

Wind Exposure B (60-80% buildings)

Wind Exposure C

Exposure Categories

- Siding, roofing, windows, skylights, exterior doors and overhead doors must be manufactured and installed to resist wind loads based on wind speed and exposure factors. (R301.2.1.4)

Wind Exposure B (60-80% buildings)

Wind Exposure C

Uplift

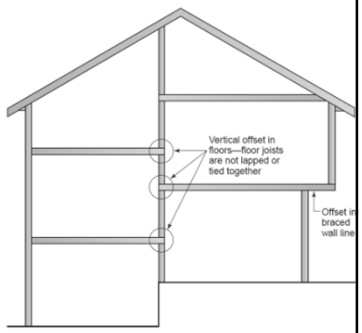
- Upward pressure caused by the ground, wind or surface water, etc.

Uplift

- Can be resisted by:
  - Dead Loads
  - Mechanical connectors (straps, hurricane ties, screws, threadedrods)
  - Sheathing

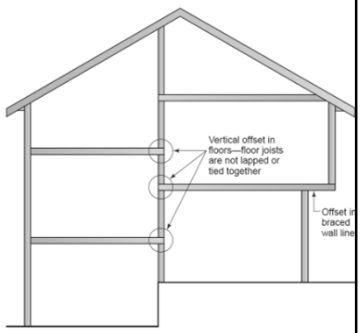
Irregular Buildings

- Buildings with offsets in braced wall lines, arrangement of openings, cantilevers, and/or f dissimilar materials in braced wall lines.



Irregular Buildings

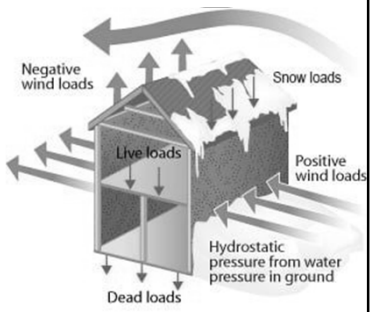
- Irregular townhome buildings in SDC C require engineering.
- Mecklenburg is no longer **SDC C**.



Design Loads

Design Loads

- The maximum amount of force the structural system is designed to resist.
  - Vertical Loads
  - Horizontal Loads



Vertical Loads

- Dead
- Live
- Snow
- Wind uplift
- Seismic and wind (overturning)
- Seismic (vertical ground motion)

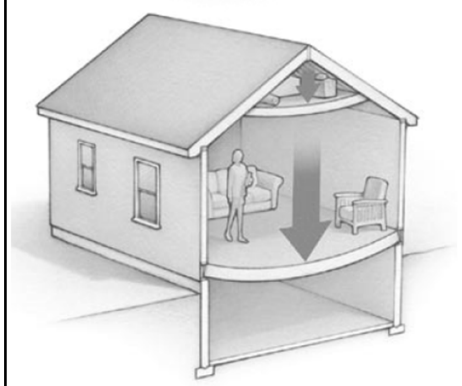
Horizontal loads

- Wind
- Seismic
- Flood (static and dynamic hydraulic forces)
- Soil (active lateral pressure)

Dead Loads

(R301.4)

Weight of all permanent components and fixed equipment

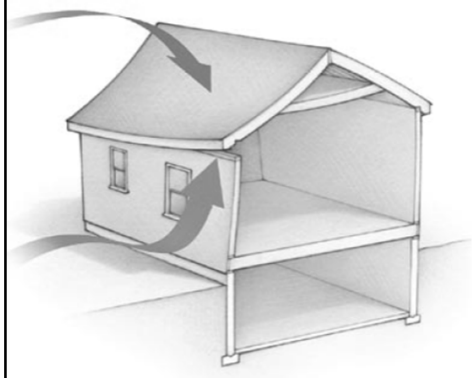


Live Loads
(R301.5)

Roof maintenance live loads (20psf.) are less than the snow load.

Soil Lateral loads

Expansive soils



Wind Loads

Ultimate wind speed 115 mph.

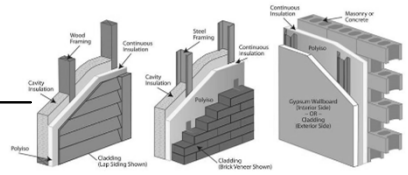
Wind Speed (Code Change 301.2.1.3)

- Wind speed terminology has changed, but the requirements are the same.
- Basic Wind Speed was **90 mph**
- Ultimate Wind Speed is **115 mph**

Basic - ASD (Allowable Stress Design)
Ultimate- LRFD (Load Resistance Factored Design)

Wind Resistance (Code Change 316.8)

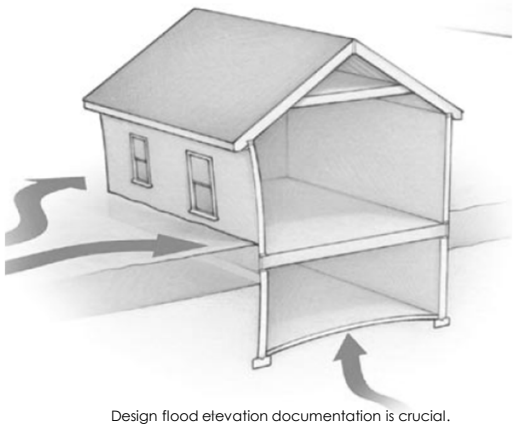
- CI as Sheathing
- ASTM C578 & C1289
- SBCA FS100 if alone.



Continuous Insulation Sheathing

Rain load become important in flat roofs

Snow/ Rain Loads

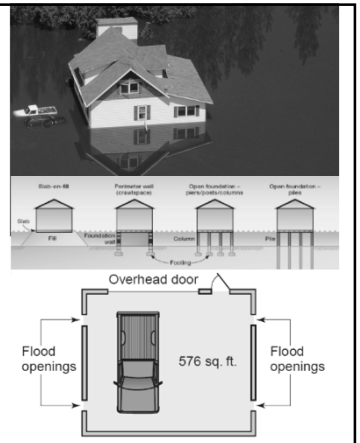


Design flood elevation documentation is crucial.

Flood Loads

Flood (Code Change)

- ASCE 24 may be used as an alternate.
- Structures must be elevated above the Flood Insurance Rate Map (FIRM) elevation or not less than 3ft.
- Parking, Building Access & Storage is allowed below the F.E. if it has flood openings per R322.2.2.1. (Doors and windows don't count).



Garage below design flood elevation used for parking and storage only

Seismic Loads

Per the seismic design category.

Seismic (Code Change)

- Mecklenburg County dropped from Category C to B.
- Therefore, anchorage not required for:
  - interior nonstructural walls and partitions,
  - cantilevered elements
  - parapets,
  - curtain wall and precast cladding
  - suspended Ceilings
  - cabinets,
  - MEP Attachments
- Projects Submitted as Cat. C will be reviewed and Inspected as Cat. C.

Site Preparation

Site Grading

- The building must be elevated sufficiently and the site graded to provide surface drainage away from the building

Site Grading

- The plans examiner considers these factors when checking the construction drawings and site plan, but the inspector is be responsible for verification.

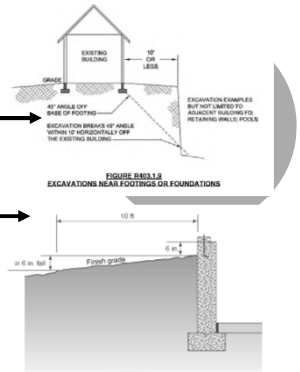
Location on Property

- Fire Separation Distance: preventing the spread of fire to buildings on the adjacent property.
- Measured from the face of the building to:
  - The lot line
  - Centerline of a street or alley
  - To an imaginary line between two buildings
- Code Change: Now 3'-0"

  (see requirements for vinyl & aluminum soffits)

Other things to look for:

- Flood Design Elevation. (if applicable)
- Excavations near. (New Section)
- Fill - 24" max. clean sand or gravel OR 8" soil.
- Drainage (R401.3).
  - Soil (5 %)
  - Concrete (2%)



Soil Properties

- Good soils:

No building drainage required. (R405)

TABLE R405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS [a]	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION [b]
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures	Good	Medium	Low
Group II	GC	Clayey gravels, gravel sand clay mixtures	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils	Unsatisfactory	Medium	High

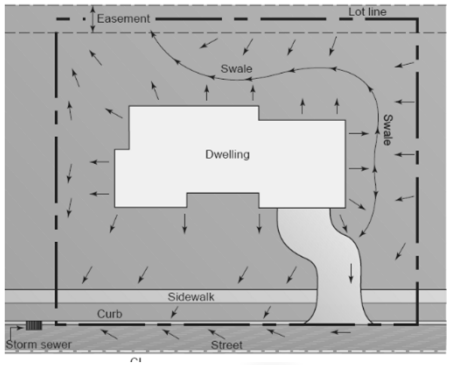
For SI: 1 inch = 25.4 mm.

a. The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.

b. Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

Storm drainage

- Based on our local storm drainage damage history; our department only performs visual storm-drainage inspection without measurement.



Footings

Materials

- The typical materials are ***Concrete*** and **CMU** but the code does not intend to limit the use of different materials.
- The code permits engineered designs for all other materials.

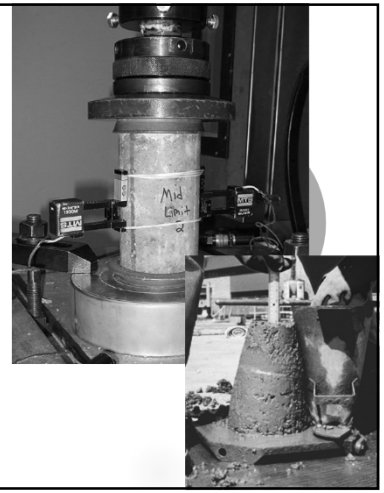
Compressive Strength

- The code requires concrete to have a minimum 28-day(85%) compressive strength of 2,500 psi for most applications.

TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE

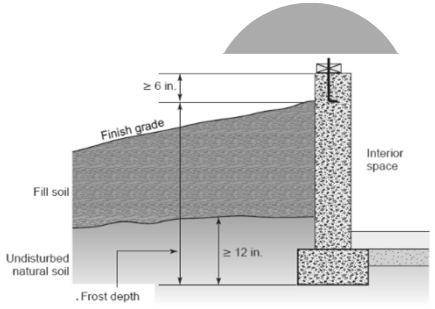
TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH[a] of f'_c		
	Weathering Potential[b]		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500[c]
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500[c]
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000[d]	3,000[d]
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000[d, e, f]	3,500[d, e, f]

For SI: 1 pound per square inch = 6.895 kPa.
a. Strength at 28 days psi.
b. See Table R301.2(1) for weathering potential.
c. Concrete in these locations that is subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.
d. Concrete shall be air-entrained. Total air content (percent by volume of concrete) shall be not less than 5 percent or more than 7 percent.
e. See Section R402.2 for maximum cementitious materials content.
f. For garage floors with a steel-troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.



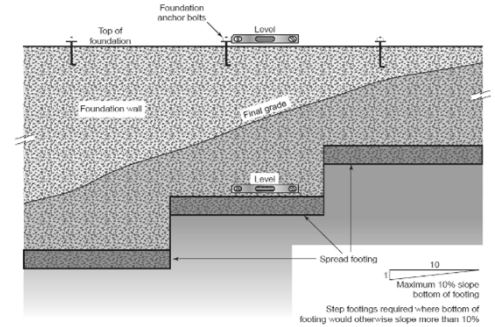
Depth

- Vegetation, wood, debris, loose or frozen soil and any other detrimental materials are removed prior to placing concrete
- 12" Below min.



Bearing and Slope

- To prevent sliding and to adequately transfer loads to the soil, the code limits the slope of the bottom of footings to a maximum of 1:10. (10% Slope)
- The top shall be limited to ½" : 10'-0".



Stepped footing

Foundation Types

- Crawl space.
- Basement.
- Slab-on-grade with stem wall.
- Monolithic slab.
- Piles.
- Piers.
- Alternative methods.

Sizing Concrete Footings

- The table is based on the:
  - number of stories supported
  - method of construction
  - load-bearing value of the soil
  - Tributary area
  - Average gravity loads (dead, live, snow)

TABLE R403.1(1)
MINIMUM WIDTH OF CONCRETE, PRECAST OR MASONRY FOOTINGS (inches)[a]

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	4,000
Conventional light-frame construction				
1-story	12[b]	12[b]	12	12
2-story	15[b]	12[b]	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12[b]	12[b]	12	12
2-story	15[b]	13[b]	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12[b]	12	12
2-story	29	21	14	12
3-story	42	32	21	16

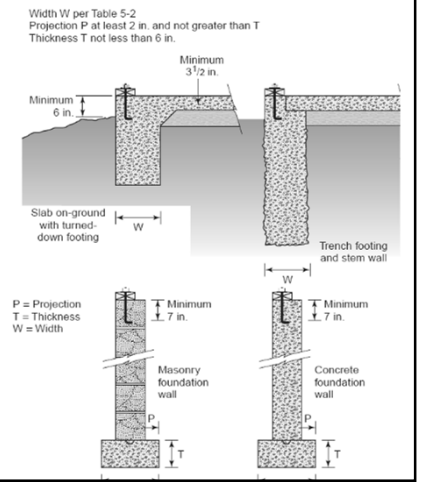
For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Where minimum footing width is 12 inches, use of a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted.

b. A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

Types of Continuous Footings

- Slab on-grade with turned down footing.
- Trench footing and stem wall.
- Masonry foundation wall
- Concrete foundation wall.



Continuous Footing Sizing

(R403.1)

- Number of stories
- Method of Construction
- Soil Bearing capacity

TABLE R403.1(1)
MINIMUM WIDTH OF CONCRETE, PRECAST OR MASONRY FOOTINGS (inches)[a]

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	4,000
Conventional light-frame construction				
1-story	12[b]	12[b]	12	12
2-story	15[b]	12[b]	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12[b]	12[b]	12	12
2-story	15[b]	15[b]	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12[b]	12	12
2-story	29	21	14	12
3-story	42	32	21	16

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b. A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

TABLE R403.1(2)
PIER[a] AND FOOTING[b] SIZES FOR SUPPORT OF GIRDERS

AREA[c]	1 (ONE) STORY		2 (TWO) STORY		$2\frac{1}{2}$ (TWO & ONE HALF) STORY	
	Pier[d, e]	Footing	Pier[d, e]	Footing	Pier[d, e]	Footing
50	8" × 16"	1'-4" × 2'-0" × 8"	8" × 16"	1'-4" × 2'-6" × 8"	8" × 16"	1'-4" × 2'-6" × 8"
100	8" × 16"	1'-4" × 2'-0" × 8"	8" × 16"	2'-0" × 2'-0" × 10"	16" × 16"	2'-6" × 2'-6" × 10"
150	8" × 16"	2'-0" × 2'-0" × 8"	16" × 16"	2'-8" × 2'-8" × 10"	16" × 16"	3'-0" × 3'-0" × 10"
200	8" × 16"	2'-4" × 2'-4" × 10"	16" × 16"	3'-0" × 3'-0" × 10"	16" × 16"	4'-0" × 4'-0" × 1'-0"
250	—	—	16" × 16"	3'-4" × 3'-4" × 1'-0"	16" × 24"	4'-0" × 4'-0" × 1'-0"
300	—	—	16" × 16"	3'-8" × 3'-8" × 1'-0"	16" × 24"	4'-6" × 4'-6" × 1'-0"

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Pier sizes are based on hollow CMU capped with 4 inches of solid masonry or concrete for 1 (one) story and 8 inches of solid masonry or concrete for 2 (two), $2\frac{1}{2}$ (two and one half) or 3 (three) story houses or shall have cavities of the top course filled with concrete or grout or other approved methods. Mortar shall be Type S. A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

b. Footing sizes are based on 2000 psf allowable soil bearing and 2500 psi concrete. This table is based on the limitations of a tributary area using dimensional framing lumber only.

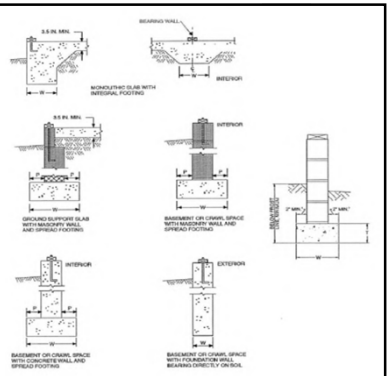
c. Centers of piers shall bear in the middle one-third of the footings. Girders must have full bearing on piers. Footings shall be full thickness over the entire area of the footing.

d. Pier sizes given are minimum. For height/thickness limitations see Section R606.7.

e. Area at first level supported by pier and footing in square feet.

Foundation Notes

- **A.** Foundations shall extend not less than 12 inches below finished grade and in no case less than the frost line depth.
- **B.** Footing sizes are based on soil with an allowable soil pressure of 2,000 pounds per square foot. Footings on soil with a lower allowable soil pressure shall be designed in accordance with accepted engineering practice.
- **C.** Footing projections shall not exceed the footing thickness.
- **D.** For minimum footing width (W) see Table R403.1(1).
- **E.** Minimum footing thickness (T) is: 6" for 1 story, 8" for 2 story and 10" for 3 story.
- **F.** Install anchor bolts per Section R403.1.6.



For SI: 1 inch = 25.4 mm.
W = Width of footing. T = Thickness of footing and P = Projection per Section R403.1.1.

Notes:
a. Foundations shall extend not less than 12 inches below finished grade and in no case less than the frost line depth.
b. Footing sizes are based on soil with an allowable soil pressure of 2,000 pounds per square foot. Footings on soil with a lower allowable soil pressure shall be designed in accordance with accepted engineering practice.
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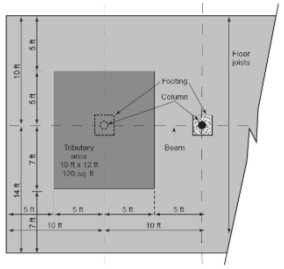
e. Minimum footing thickness (T) is: 6" for 1 story, 8" for 2 story and 10" for 3 story.
f. Install anchor bolts per Section R403.1.6.

FIGURE R403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS[a, b, c, d, e, f]

Pier Size



Tributary

TABLE R403.1(2)
PIER[a] AND FOOTING[b] SIZES FOR SUPPORT OF GIRDERS

AREA[c]	1 (ONE) STORY		2 (TWO) STORY		$2\frac{1}{2}$ (TWO & ONE HALF) STORY	
	Pier[d, e]	Footing	Pier[d, e]	Footing	Pier[d, e]	Footing
50	8" × 16"	1'-4" × 2'-0" × 8"	8" × 16"	1'-4" × 2'-6" × 8"	8" × 16"	1'-4" × 2'-6" × 8"
100	8" × 16"	1'-4" × 2'-0" × 8"	8" × 16"	2'-0" × 2'-0" × 10"	16" × 16"	2'-6" × 2'-6" × 10"
150	8" × 16"	2'-0" × 2'-0" × 8"	16" × 16"	2'-8" × 2'-8" × 10"	16" × 16"	3'-0" × 3'-0" × 10"
200	8" × 16"	2'-4" × 2'-4" × 10"	16" × 16"	3'-0" × 3'-0" × 10"	16" × 16"	4'-0" × 4'-0" × 1'-0"
250	—	—	16" × 16"	3'-4" × 3'-4" × 1'-0"	16" × 24"	4'-0" × 4'-0" × 1'-0"
300	—	—	16" × 16"	3'-8" × 3'-8" × 1'-0"	16" × 24"	4'-6" × 4'-6" × 1'-0"

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Pier sizes are based on hollow CMU capped with 4 inches of solid masonry or concrete for 1 (one) story and 8 inches of solid masonry or concrete for 2 (two), $2\frac{1}{2}$ (two and one half) or 3 (three) story houses or shall have cavities of the top course filled with concrete or grout or other approved methods. Mortar shall be Type S. A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

b. Footing sizes are based on 2000 psf allowable soil bearing and 2500 psi concrete. This table is based on the limitations of a tributary area using dimensional framing lumber only.

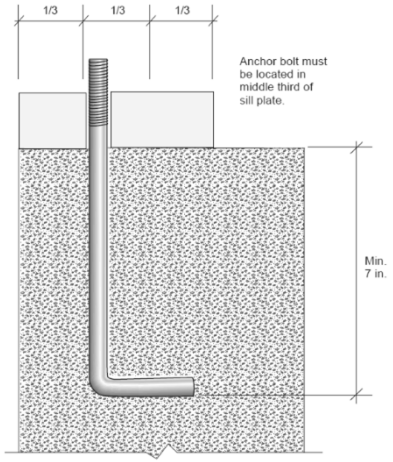
c. Centers of piers shall bear in the middle one-third of the footings. Girders must have full bearing on piers. Footings shall be full thickness over the entire area of the footing.

d. Pier sizes given are minimum. For height/thickness limitations see Section R606.7.

e. Area at first level supported by pier and footing in square feet.

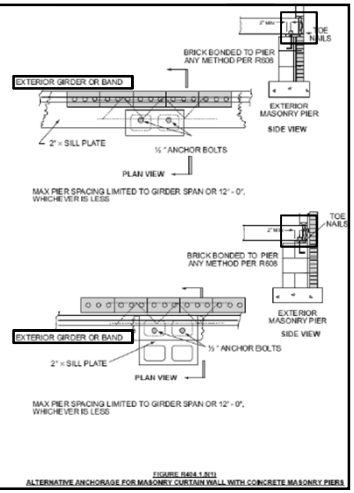
Anchor Bolts

- Anchor bolt are prescribed connect the sill plate to the foundation.
- Other methods, such as foundation straps, may be used if installed according to the manufacturer's instructions and in a way to provide equivalent anchorage. Such alternatives typically require closer spacing than for embedded anchor bolts



Code Modifications

- New Diagram Showing an Alternative Anchorage for Masonry Curtain with Concrete Masonry Piers . (See the location of the Girder and sill plate)



Code Modifications

- **R404.1.5.3 Pier and curtain wall foundations.**

Use of pier and curtain wall foundations shall be permitted to support light-frame construction not more than two stories in height, provided the following requirements are met:

1. Curtain walls shall be bonded into piers and supported on concrete footings poured integrally with pier footings.

2.The minimum actual thickness of curtain walls shall be not less than 4 inches (102 mm) nominal or 3 3/8 inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with Section R606.6.4.

3.Piers shall be constructed in accordance with SectionsR606.7 and R606.7.1, and shall be bonded into the loadbearing masonry wall in accordance with Section R606.13.1 or R606.13.1.1.

4.The maximum height of pier and curtain wall foundations shall be not more than 6 feet (1829mm).

Code Modifications

- **R405.1 Concrete or Masonry Foundations**

Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved foundations. systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (152 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded within approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

Foundation Walls

Masonry and Concrete Foundation Walls

Unlike footings, where gravity loads are the primary consideration, foundation walls must be constructed to resist lateral loads, particularly from soil pressure.

Wall Height and Thickness

Determined by:

- Type
- Soil type
- Height of backfill
- Height of the foundation

TABLE R404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS[f]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[c] (feet)	PLAIN MASONRY[a] MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes[b]		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6 solid[d] or 8	6 solid[d] or 8	6 solid[d] or 8
	5	6 solid[d] or 8	8	10
6	4	6 solid[d] or 8	6 solid[d] or 8	6 solid[d] or 8
	5	6 solid[d] or 8	8	10
	6	8	10	12
7	4	6 solid[d] or 8	8	8
	5	6 solid[d] or 8	10	10
	6	10	12	10 solid[d]
	7	12	10 solid[d]	12 solid[d]
8	4	6 solid[d] or 8	6 solid[d] or 8	8
	5	6 solid[d] or 8	10	10
	6	10	12	12 solid[d]
	7	12	12 solid[d]	Footnote e
	8	10 grout[d]	12 grout[d]	Footnote e
9	4	6 grout[d] or 8 solid[d] or 12	6 grout[d] or 8 solid[d]	8 grout[d] or 10 solid[d]
	5	6 grout[d] or 10 solid[d]	8 grout[d] or 12 solid[d]	8 grout[d]
	6	8 grout[d] or 12 solid[d]	10 grout[d]	10 grout[d]
	7	10 grout[d]	10 grout[d]	12 grout
	8	10 grout[d]	12 grout	Footnote e
	9	12 grout	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.
a. Mortar shall be Type M or S and masonry shall be laid in running bond. Ungrouted hollow masonry units are permitted except where otherwise indicated.
b. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
c. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
d. Solid indicates solid masonry unit; grout indicates grouted hollow units.
e. Wall construction shall be in accordance with either Table R404.1.1(2), Table R404.1.1(3), Table R404.1.1(4), or a design shall be provided.
f. The use of this table shall be prohibited for soil classifications not shown.

Reinforcement

- When required, the location, size, and spacing of vertical reinforcing depend on the:
  - minimum yield strength (grade) of the steel
  - thickness of the wall

TABLE R404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d ≥ 6 INCHES[a, e, f]

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL[a]	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[b, c]		
		Soil classes and lateral soil load[d] (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet 8 inches	#4 at 48	#5 at 48	#6 at 48
7 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet 4 inches	#5 at 48	#6 at 48	#6 at 40
8 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#5 at 48	#6 at 48	#6 at 32
8 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet 8 inches	#6 at 48	#6 at 32	#6 at 24
9 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#6 at 48	#6 at 40	#6 at 24
	9 feet 4 inches	#6 at 40	#6 at 24	#6 at 16
10 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 32
	8 feet	#6 at 48	#6 at 32	#6 at 24
	9 feet	#6 at 40	#6 at 24	#6 at 16
	10 feet	#6 at 32	#6 at 16	#6 at 16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.
a. Mortar shall be Type M or S and masonry shall be laid in running bond.
b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B and C.
c. Vertical reinforcement shall be Grade 60 minimum. The distance d from the face of the soil side of the wall to the center of vertical reinforcement shall be not less than 5 inches.
d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.
e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
f. The use of this table shall be prohibited for soil classifications not shown.

Code changes

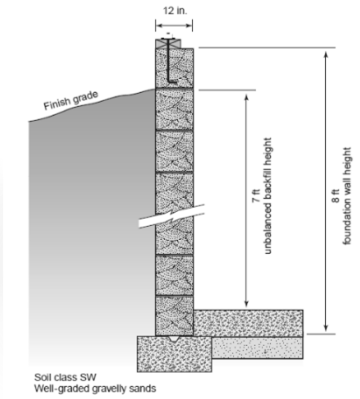


TABLE R404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d ≥ 8.75 INCHES[a, b, f]

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL[c]	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[a, c] Soil classes and lateral soil load[d] (psf per foot below grade) GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet 8 inches	#4 at 72	#4 at 72	#5 at 72
7 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet 4 inches	#4 at 72	#5 at 72	#6 at 72
8 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#5 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 64
8 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet 8 inches	#5 at 72	#7 at 72	#6 at 48
9 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 56
	9 feet 4 inches	#6 at 72	#6 at 48	#6 at 40
10 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 48
	9 feet	#6 at 72	#6 at 56	#6 at 40
	10 feet	#6 at 64	#6 at 40	#6 at 32

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. Mortar shall be Type M or S and masonry shall be laid in running bond.

b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B and C.

c. Vertical reinforcement shall be Grade 60 minimum. The distance, d, from the face of the soil side of the wall to the center of vertical reinforcement shall be not less than 8.75 inches.

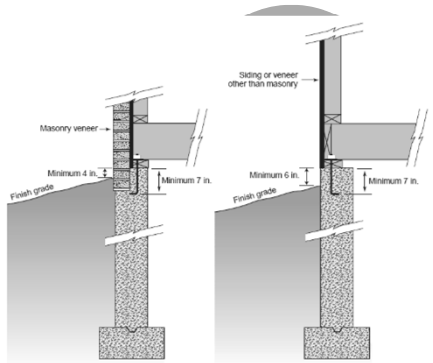
d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.

e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab is permitted.

f. The use of this table shall be prohibited for soil classifications not shown.

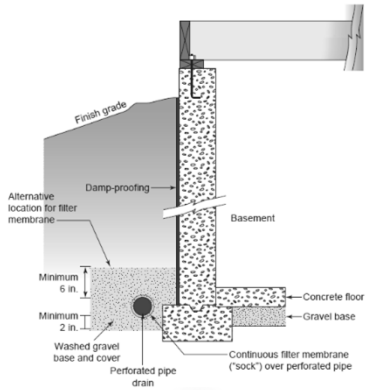
Height above finished grade

- The code intends to protect the building from moisture intrusion that may damage portions of the structure and cause an unhealthy living environment.
- 6" Wood OR 4" Masonry



Moisture Protection

- For foundations that retain earth and enclose spaces located below grade, the code requires foundation drainage and dampproofing or waterproofing to prevent moisture from penetrating into such spaces



Foundation Drainage

- Perforated drains require installation of a filter membrane unless the manufacturer recommends otherwise.
- The drainage system is required to discharge by gravity or mechanical means to an approved location.

Dampprofing

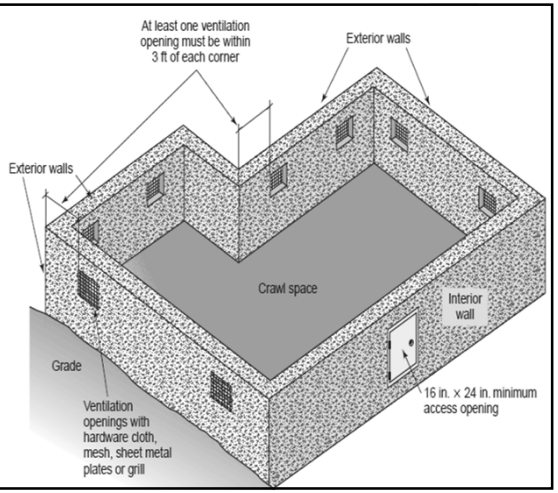
- A bituminous-based coating or other approved dampprofing materials are applied to the exterior of the foundation, typically from the top of the footing to the finished grade.

Waterproofing

- Waterproofing provides a higher level of protection against moisture under hydrostatic pressure.
- Areas with a high water table or other known severe soil-water conditions require waterproofing. Typically consisting of flexible sealants or other impervious material and applied in thicker coatings.

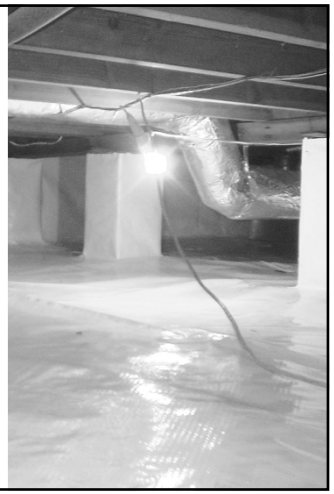
Crawlspace Ventilation

- Vents
- Mechanical



Conditioned crawl

- Intentionally returning air from the crawl space to space conditioning equipment that serves the dwelling shall be allowed.
- Foam plastic insulation located in a crawl space plenum shall be protected against ignition by an approved thermal barrier. (R409.5.5)
- Inspection gap 3" min.- 4"max.



Questions?

Next Meeting:

April 3rd

- Framing & Bracing
- Townhome Design

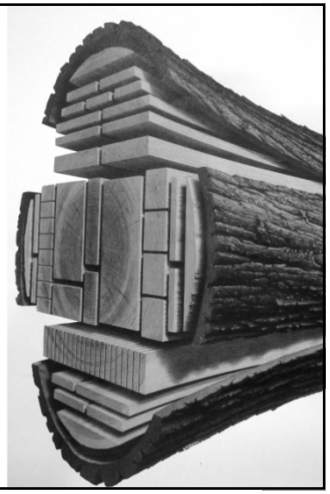
April 2019

Light-Frame Construction

Framing Lumber

- This presentation will focus on Chapter 6: Wall Construction.

Basic Concepts



Framing Lumber

- New definitions:
  - Cross laminated Timber
  - Engineered Wood Rim Board
  - Structural Composite Lumber

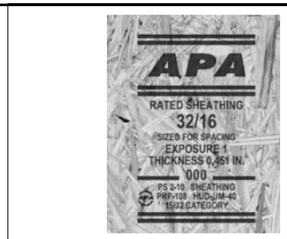
Framing Lumber

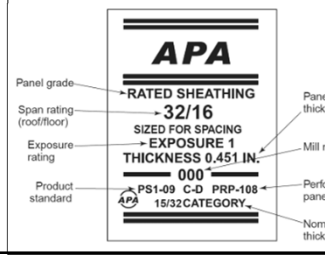
- Framing lumber or "dimensional lumber" runs roughly 15% to 20% of total house cost.

Lumber Grades

R502.1, R503.2, R602.1, R803.1, R803.2

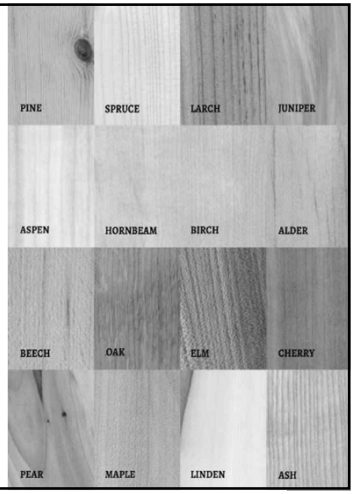
- Grades:
  - SS#1 – 80% clear
  - #2 – 66% clear
  - #3 – 50% clear
- Moisture:
  - S-Green >19%
  - S-Dry <19%
  - MC15 <15%
- Most framing lumber is #2. Lower grades are special ordered.
- Southern Yellow Pine – Easily Pressure treated.





Lumber Species

- Douglas Fir-Larch
- Hem-Fir
- Southern Pine (typically pressure treated)
- Spruce-Pine-Fir



Dry Lumber

- **Design Values:** Based in normal conditions (lumber with a moisture content <= 19% placed on edge).

Dry lumber

- Stamped K-D (kiln-dried) or S-Dry (surface dry).
- Anything larger than a 6x6 is generally not available K-D.

Sawmill letters

To Whom it May Concern,

In August 2018 I milled several thousand board feet of lumber for Mr. Hayes. On March 30 2019, I returned to Mr. Hayes' residence to measure moisture content and grade the lumber. The lumber is organized into five stacks. The moisture content and grades are as follows:

Stack 1 – #2 Grade Pine 14% moisture content

Stack 2 - #2 Grade Pine 8.3% moisture content

Stack 3 - #2 Grade Pine Moisture content ranges from 10.4% (bottom layers) to 8.5 % (top layers)

Stack 4 - #2 Grade Pine Moisture content ranges from 14% (bottom layers) to 16% (top layers)

Stack 5 - #2 Grade Pine Moisture content ranges from 12.7% (bottom layers) to 9.3% (top layers)

If you have any questions, please call me and I will be happy to provide additional information. My cell phone number is 828-899-7272 or you may also reach me at the office number above.

Wet Lumber

- Wet lumber or flat members: require higher values.
- Wet Service Factor: Safety factor applied to wood that will be used in a wet condition (e.g. uncovered structures)

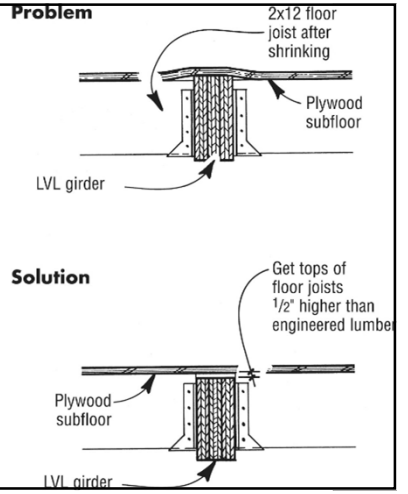
AWPA U1 Use Category[1]

U1-Use Category	Service Conditions	Use Environment	Typical Applications
UC3B: Above Ground, Exposed	Exterior construction, above ground, uncoated, or poor water run off	Exposed to all weather cycles, including intermittent wetting but with sufficient air circulation so wood can readily dry	Decking, railings, joists and beams for decks, fence pickets, uncoated millwork
UC4A: Ground Contact, General Use	Ground contact or fresh water, non-critical components	Exposed to all weather cycles, including continuous or prolonged wetting	Fence posts, deck posts, guardrail posts, joists and beams for decks, crossties & utility poles (low decay areas)
UC4B: Ground Contact, Heavy Duty	Ground contact or fresh water, critical components or difficult replacement	Exposed to all weather cycles, high decay potential includes salt water splash	Building poles, horticultural posts, crossties & utility poles (high decay areas)
UC5A: Marine Use, Northern Waters	Salt or brackish water and adjacent mud zone which includes Long Island, NY and northward, north of San Francisco	Continuous marine exposure (salt water)	Piling, bulkheads, bracing
UC5B: Marine Use, Central Waters	Salt or brackish water and adjacent mud zone, south of Long Island, NY to southern border of GA, south of San Francisco	Continuous marine exposure (salt water)	Piling, bulkheads, bracing
UC5C: Marine Use, Southern Waters	Salt or brackish water and adjacent mud zone, south of GA, gulf coast, Hawaii, and Puerto Rico	Continuous marine exposure (salt water)	Piling, bulkheads, bracing

[1] Excerpts from AWPA U1-17, *Use Category System: User Specification for Treated Wood*, Table 2-1

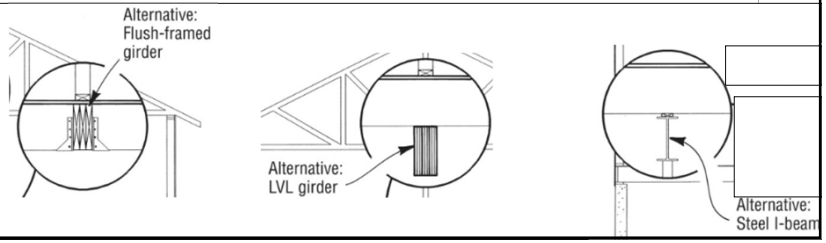
Cumulative Shrinkage

- Large carrying beams can cause one part of a house to settle more than others, causing drywall cracks and other problems.



How to reduce shrinkage:

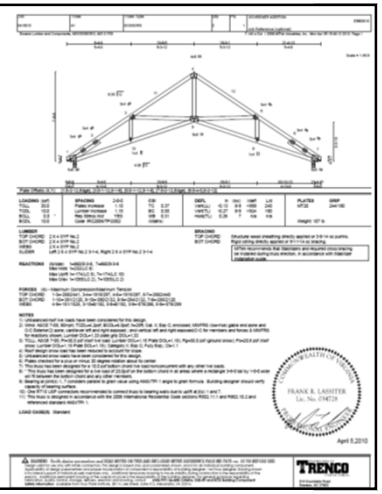
- Using girders with hangers
- Engineered lumber (LVL)
- Steel



Trusses

R502.11, R802.10

- Truss design drawings must be submitted to the inspector for review and approval prior to truss installation.
- Alterations to trusses are allowed with the approval of a RDP.



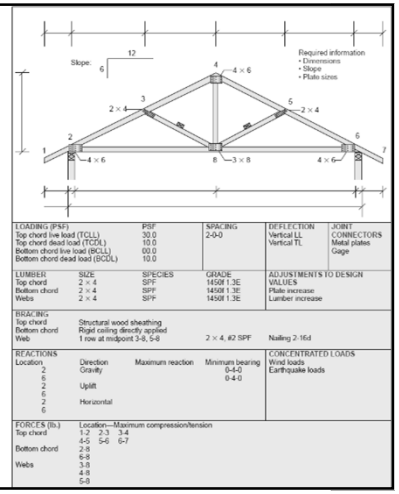
Engineered Wood Products

Ch. 2

- Plate-connected open web trusses.
- I-joists.
- Glued laminated lumber.
- Laminated veneer lumber.
- Structural composite lumber.

Required Information

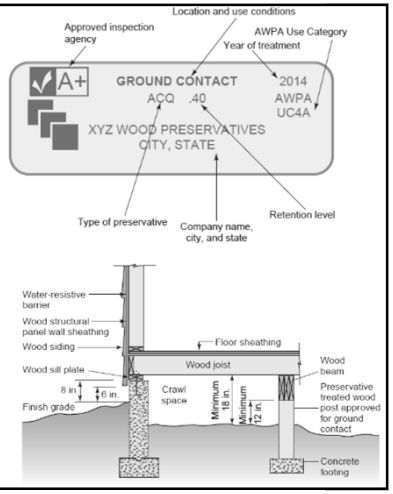
- Loading
- Spacing
- Deflection
- Connectors
- Lumber
- Adjustments
- Bracing
- Reactions
- Loads
- Forces.



Wood Treatment

R317

- To resist corrosion and maintain structural load capacity, the code generally requires fasteners and connectors used in preservative and FRT to be:
- Hot-dipped galvanized
- Zinc-coated galvanized
- Steel or stainless steel
- Silicon bronze or copper
- Or any other material recommended by the manufacturer.



Fireblocking

R302.11

- Stops the spread of fire in concealed spaces of wood frame construction.
- Required at 10 ft. intervals on walls with offset studs or other openings.
- Fireblocking materials include:
  - Nominal 2-inch-thick lumber,
  - Equivalent layers of structural wood panels
  - Glass fiber insulation securely retained in place.

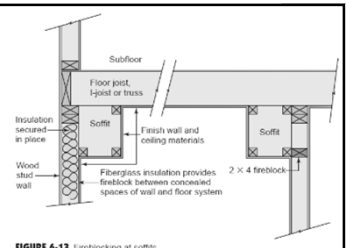
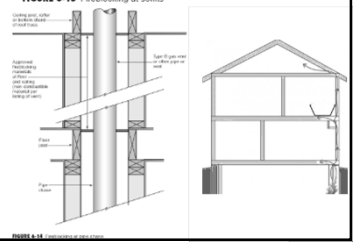
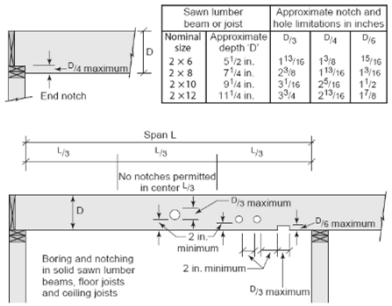


FIGURE 6-13 Fireblocking at soffits



Cutting, Boring and Notching

R502.8, R602.6, R802.7



Sawn lumber beam or joist		Approximate notch and hole limitations in inches		
Nominal size	Approximate depth 'D'	$D/3$	$D/4$	$D/6$
2 × 6	5 1/2 in.	1 13/16	1 3/8	15/16
2 × 8	7 1/4 in.	2 3/8	1 13/16	1 3/16
2 × 10	9 1/4 in.	3 1/16	2 5/16	1 1/2
2 × 12	11 1/4 in.	3 3/4	2 13/16	1 7/8

FIGURE 6-9 Boring and notching in solid sawn beams, floor joists and ceiling joists

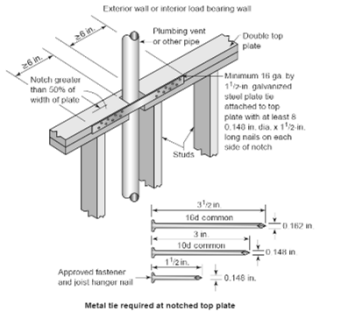


FIGURE 6-12 Drilling and notching of top plate in exterior wall or bearing interior wall

Draftstopping

R302.12

- The code requires draftstopping to divide the horizontal spaces into areas of 1,000 square feet or less.
- One-half-inch gypsum board and 3/8 inch wood structural panels are approved draftstopping materials.

Sheathing Inspections

Interpretation reversal

- The new ruling change will allow single family construction projects to install the exterior siding before the framing inspection as long as the exterior cladding does not cover any lintels ~~or~~ that are bolted to the framing members.

Interpretation reversal

- On November 27, 2018, the BCC reversed NCDOI's interpretation on exterior papering, siding, or roofing; which NCDOI had stated, "shall **not** be installed prior to the completion of the framing inspection."

Voluntary Sheathing Inspection

- As a result, it is now only possible for AHUs to inspect other exterior sheathing requirements through a voluntary sheathing inspection.

In simple terms…

Sheathing Components that are not accessible or visible are SELF-REGULATED!

Items that may not be visible

- Fasteners for preservative-treated wood are per code and/or manufacturer's specifications. (e.g. hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper.)
- Anchor bolts, straps, lateral straps, hold downs or any other required fasteners are located, sized and/or spaced per code and/or engineering. (not over spalled)

Items that may not be visible

1. Wall or roof sheathing panels are stamped and meet the required grade and thickness per code and/or engineering.

2. Shear walls, braced wall panels, portal frames and /or cripple bracing: edges field and joints are blocked and nailed per code and/or engineering.

Items that may not be visible

- Fastener heads or crowns fully penetrate the sheathing and are firmly driven into the framing (not over-driven nor under-driven)
- Full height studs are provided at strapping and hold-downs or as allowed by the manufacturer's specifications.

Items that may not be visible

- Diaphragm connectors are installed per code and/or engineering.
- Roof eaves, rafter tails and sheathing materials are per code and as required by the fire separation distance requirements.

Items that may not be visible

- Concealed insulation at bathtubs, fireplaces and chases etc.is installed.
- Moisture barrier: house wrap, flashings, lintels, window and door installations.

Items that may not be visible

- Rated area separation walls are continuous at exterior offsets.
- Exterior rated walls have continuous sheathing per the rated design.

Process

- The optional Sheathing Inspection fee in Mecklenburg County is $50.00 per site visit ($25.00 per townhouse when grouped in pairs).
- You must request a sheathing inspection in the permit application with comment note expressing the type of sheathing inspection required.

Inspection request examples:

- "Exterior sheathing including structural, non-structural, fire separation, moisture and energy."
- "Interior only for energy inspection or framing behind tubs, fireplaces and concealed spaces."
- "Exterior sheathing structural only."

RDP's Responsibility

- On plans that are designed & sealed by an architect or engineer, MCCE will not perform specific calculations for prescriptive bracing methods to confirm proper amounts of wall bracing are being provided.

Contractor's Responsibility

- Compliance of sheathing items not visible to the inspectors, is the Contractor's Responsibility.

Inspector's Responsibility

- If bracing amounts are found to be below the required min. in the field, the condition shall be corrected by the Field Inspector through a Notice of Violation (NOV).

Plan Review's Responsibility

- Plan Reviewers will still require engineers to specify the bracing method, locations of braced wall lines & panels, and the method of attachment for braced wall panels.

Wall Bracing

History of wall bracing

- Wall bracing requirements are not new to the codes.
- In fact, several of the current bracing methods, including let-in bracing, diagonal wood boards and Portland cement plaster, reflect conventional construction practices that were common over 50 years ago.

History of wall bracing

- The 2012 IRC reworded the bracing section to make it more understandable and consistent.
- The 2012 IRC added the Simplified Method and 2012 NCRC incorporated it as an amendment.

History of wall bracing

- The 2000 IRC introduced several new bracing provisions and methods:
  - minimum bracing percentage
  - maximum braced wall line spacing
  - continuous sheathing
  - portal frames
  - separate bracing requirements for wind and seismic

History of wall bracing

- The 2015 IRC has a few additional tweaks to wall bracing due to changes in proprietary hold-down straps and the relative strength of Method CS-PF compared to Method PFG .
- The 2018 NCRC didn't incorporate these changes and is essentially the same code we had in 2012.
- NCRC wall bracing section is about twice as long as the NCRC.

Why is it important to understand it?

The better the code is understood, the more likely it is to be correctly applied and enforced.

The more you know, the easier your job is.

Wall Attachment Failures

Why are code updates important?

- We don't build like we used to.
- Larger homes and openings.

Braced Wall Failure

Wall-to-foundation connection Failure

Basic Concepts

5 Ways to Comply with Bracing

R602.10

1. Isolated panel bracing (R602.10.2)
2. Continuous sheathing (R602.10.3)
3. Engineered design (R602.10.5)
4. 2015 IRC, Section R602.10
5. SR-102 as published by APA

Code Change

Seismic Category
Table R301.2(7)

Mecklenburg County dropped from

Category C to B

.

Category B

Anchorage no longer required for:

- Interior Nonstructural walls and partitions
- Cantilevered elements, parapets
- Curtain wall and Precast cladding
- Suspended Ceilings
- Cabinets
- MEP Attachments

- Very good but limited to small homes with limited openings.
- Requires craftsmanship

- ½ the capacity of the others

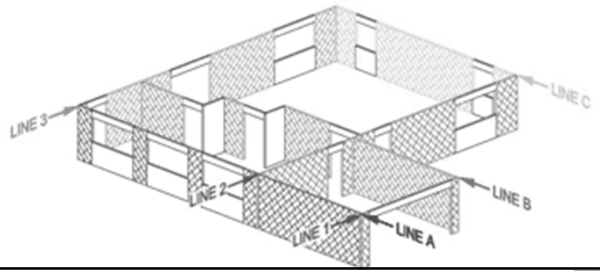
- 2 continuous methods.
- CS-WSP provides the greatest capacity

TABLE R602.10.1
BRACING METHODS[a, b]

METHOD	MINIMUM BRACE MATERIAL THICKNESS OR SIZE	MINIMUM BRACE PANEL LENGTH OR BRACE ANGLE	CONNECTION CRITERIA		FIGURE OF BRACING METHOD, NOT NECESSARILY LOCATION
			Fasteners	Spacing	
LIB Let-in-bracing	1 × 4 wood brace (or approved metal brace installed per manufacturer instructions)	45° angle for maximum 16" o.c. stud spacing[c]	2-8d common nails or 3-8d (2½" long × 0.113" dia.) nails	Per stud and top and bottom plates	
DWB Diagonal wood boards	¾" (1" nominal)	48"	2-8d (2½" long × 0.113" diameter) or 2 – 1½" long staples	Per stud and top and bottom plates	
WSP Wood structural panel	⅜"	48"[d]	6d common nail or 8d (2" long × 0.113" diameter) nail [See Table R602.3(3)]	6" edges 12" field	
SFB Structural fiberboard sheathing	½"	48"[d]	1½" long × 0.120" diameter galvanized roofing nails	3" edges 6" field	
GB Gypsum board installed on both sides of wall	½"	96" for use with R602.10.2 48" for use with R602.10.3	Minimum 5d cooler nails or #6 screws	7" edges 7" field	
PCP Portland cement plaster	¾" (maximum 16" o.c. stud spacing)	48"	1½" long, 11 gage, ½" diameter head nails or ⅞" long 6 gage staples	6" o.c. on all framing members	
CS-WSP[e, i] Continuously sheathed WSP	⅜"	24" adjacent to window not more than 67% of wall height; 30" adjacent to door or window greater than 67% and less than 85% of wall height; 48" for taller openings.	Same as WSP	Same as WSP	
CS-SFB[e, i] Continuously sheathed SFB	½"		Same as SFB	Same as SFB	
PF Portal Frame[f, g, h]	⅜"[g]	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1	

Braced Wall Line

An imaginary straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.



Continuous Sheathed Braced Panel

- Continuous sheathing must extend up the gable end walls if present.
- This ensures that the continuous sheathing load path is intact from the foundation to the roof diaphragm.

Diaphragm

- A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements.
- When the term "diaphragm" is used, it includes horizontal bracing systems. e.g. floor and roof

Shear Wall is engineered.

- Wood structural panels
- Pre-engineered hold downs in addition to anchor bolts.

Braced wall is prescriptive.

- Braced Wall Panels
- Anchor bolts.

What is the main difference between a shear wall and a braced wall?

Shear Wall

- A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing.
- Designed in accordance with Chapter 6 of the code and the associated limitations in Section R301.2 of the code (seismic).

Braced Wall Panel

- A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors.

Two basic methods of bracing:

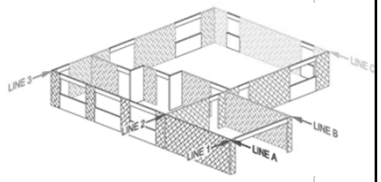
Intermittent

Continuous

Bracing Methods

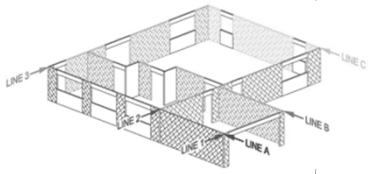
Mixing Methods NCRC (R602.10.1)

- Mixing methods is allowed in the NCRC. Except for CS-WSP & CS-SFB. (Footnote i)
  - (possibly because CS-SFB is not allowed in high seismic zones)



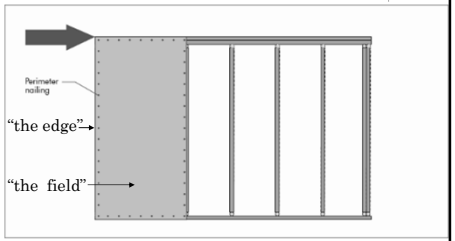
Mixing Methods IRC (R601.10.4.1)

- Mixing intermittent methods within the story is allowed in low risk categories (wind + seismic). (Most restrictive)
- Mixing intermittent with continuous within the same wall line is NOT allowed in the IRC unless otherwise noted.
- CS-SFB is not allowed with CS-type portal frames because deflection compatibility has not been established.



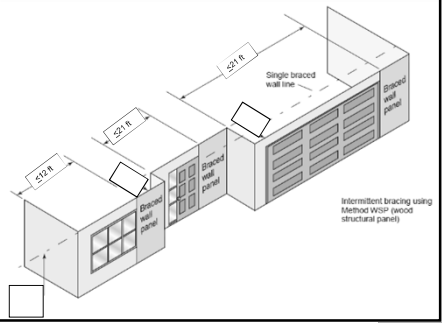
Intermittent

- Edge nailing can be 3-7" depending on the method.
- Field nailing can be 6-12" depending on the method.



Intermittent

- Used in separate locations along a braced wall line.
- Nonstructural sheathing can be used in areas of the wall where bracing is not required.



Continuous

- The whole wall line is sheathed, including above and below openings and at gable ends .
- The whole wall line is blocked at horizontal joints.
- Requires less bracing and permits the use of narrower bracing panels

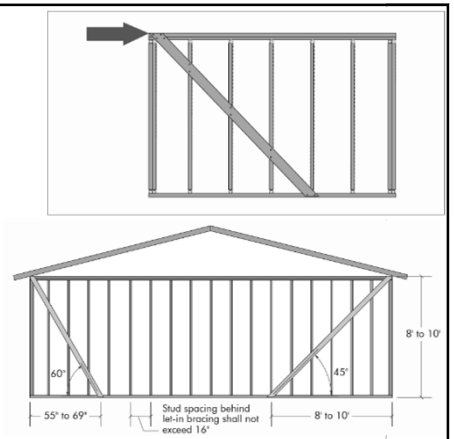
Bracing Materials and Methods

TABLE R602.10.1
BRACING METHODS[a, b]

METHOD	MINIMUM BRACE MATERIAL THICKNESS OR SIZE	MINIMUM BRACE PANEL LENGTH OR BRACE ANGLE	CONNECTION CRITERIA		FIGURE OF BRACING METHOD, NOT NECESSARILY LOCATION
			Fasteners	Spacing	
LIB Let-in-bracing	1 × 4 wood brace (or approved metal brace installed per manufacturer instructions)	45° angle for maximum 16" o.c. stud spacing[c]	2-8d common nails or 3-8d (2½" long × 0.113" dia.) nails	Per stud and top and bottom plates	
DWB Diagonal wood boards	¾" (1" nominal)	48"	2-8d (2½" long × 0.113" diameter) or 2 - 1¾" long staples	Per stud and top and bottom plates	
WSP Wood structural panel	3/8"	48"[d]	6d common nail or 8d (2½" long × 0.113" diameter) nail [See Table R602.3(3)]	6" edges 12" field	
SFB Structural fiberboard sheathing	½"	48"[d]	1½" long × 0.120" diameter galvanized roofing nails	3" edges 6" field	
GB Gypsum board installed on both sides of wall	½"	96" for use with R602.10.2 48" for use with R602.10.3	Minimum 5d cooler nails or #6 screws	7" edges 7" field	
PCP Portland cement plaster	⅞" (maximum 16" o.c. stud spacing)	48"	1½" long, 11 gage, ⅞" dia. diameter head nails or ⅞" long, 16 gage staples	6" o.c. on all framing members	
CS-WSP[e,i] Continuously sheathed WSP	3/8"	24" adjacent to window not more than 67% of wall height; 30" adjacent to door or window greater than 67% and less than 85% of wall height; 48" for taller openings	Same as WSP	Same as WSP	
CS-SFB[e,i] Continuously sheathed SFB	½"		Same as SFB	Same as SFB	
PF Portal Frame[f,g,h]	⅜"	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1	

LIB

- The effectiveness of let-in bracing depends on the craftsmanship of the framer when cutting the notches for the 1x4 brace.
- There are some metal alternate products available (ESR required).
- Both have limited structural capabilities, works well in small homes.



Notes

Notes:

a. Alternative bracing materials and methods shall comply with Section 105 of the *North Carolina Administrative Code and Policies*, and shall be permitted to be used as a substitute for any of the bracing materials listed in Table R602.10.1 provided at least equivalent performance is demonstrated. Where the tested bracing strength or stiffness differs from tabulated materials, the bracing amount required for the alternative material shall be permitted to be factored to achieve equivalence.

b. All edges of panel-type wall bracing required from Tables R602.10.1 and R602.10.3 shall be attached to framing or blocking, except GB bracing horizontal joints shall not be required to be blocked when joints are finished.

c. Two LIB braces installed at a 60° angle shall be permitted to be substituted for each 45° angle LIB brace.

d. For 8-foot (2483 mm) or 9-foot (2743 mm) wall height, brace panel minimum length shall be permitted to be reduced to 36-inch (914 mm) or 42-inch length (1067 mm), respectively, where not located adjacent to a door opening. A braced wall panel shall be permitted to be reduced to a 32-inch (813 mm) length when studs at each end of the braced wall panel are anchored to foundation or framing below using hold-down device with minimum 2,800 pounds design tension capacity. For detached single story garages and attached garages supporting roof only, a minimum 24-inch (610 mm) brace panel length shall be permitted on one wall containing one or more garage door openings.

e. Bracing methods designated CS-WSP and CS-SFB shall have sheathing installed on all sheathable surfaces above, below, and between wall openings.

f. For purposes of bracing in accordance with Section R602.10.2, two portal frame brace panels with wood structural panel sheathing applied to the exterior face of each brace panel as shown in Figure R602.10.1 shall be considered equivalent to one braced wall panel.

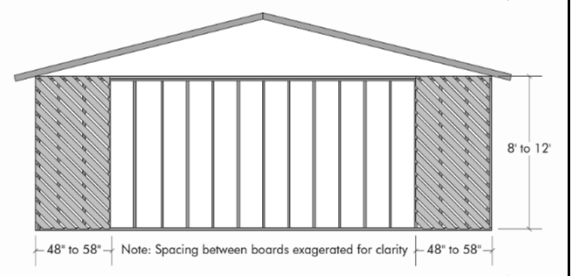
g. Structural fiberboard (SFB) shall not be used in portal frame construction.

h. No more than three portal frames shall be used in a single building elevation.

i. CS-WSP and CS-SFB cannot be mixed on the same story. Gable ends shall match the panel type of the wall below.

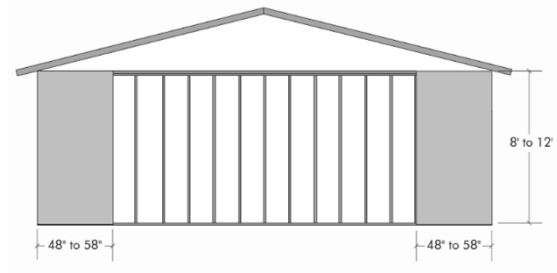
DWB

- Diagonal Wood Bracing



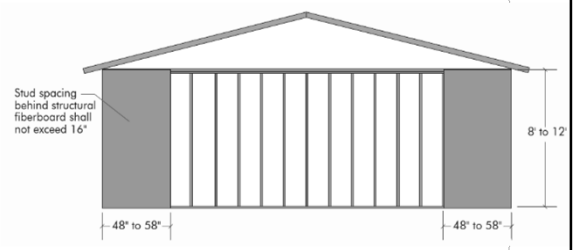
WSP

- Wood Structural Panel
- The greatest bracing capacity.



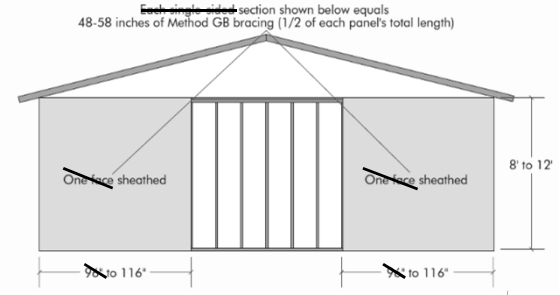
SFB

- Method SFB (structural fiberboard sheathing)



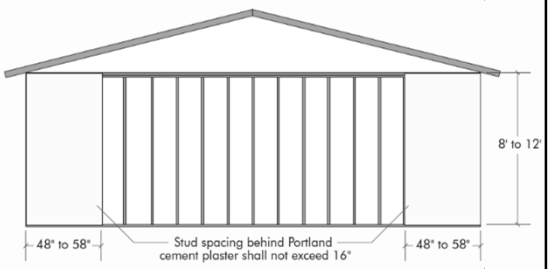
GB

- 7" Edges & 7" Field (regardless of fastener type).
- 1/2 as strong as CS-WSP . This is method with the lowest capacity.
- Requires double siding and additional length



PCP

- Portland cement plaster



PF (top defects)

- It is important to include the door transom in the calculation!
- A door is not the same as a window when doing the wall / height ratio calculation.
- Not providing reinforcement on stem walls ≤48". (other methods too)

CS-SFB

- Continuously sheathed structural fiberboard.
- Other bracing methods may not be used in a Method CS-SFB wall line.

CS-WSP

- Provides the greatest bracing capacity
- All sheathable surfaces of the exterior walls are required to have sheathing, even if the design calls for an interior braced wall line & panels.
- CS-WSP panels next to openings shall use the largest opening on either side of a panel to determine min panel size per Table R602.10.1; Include transoms in the opening height if present.

Blocking

All edges of panel-type wall bracing shall be attached to framing or blocking.

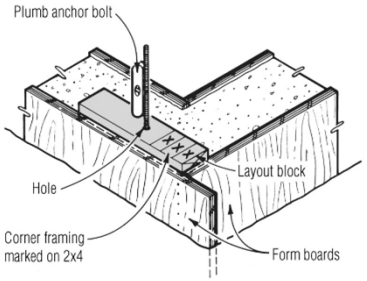
http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/2012_NCBuildingCode_amendments/R602.10%20Code%20and%20Commentary%20for%202012%20NC%20Residential%20Code%20-%20final%2003-06-13.pdf

Foundation anchorage
R403.1.6

- The wood sill plate must be anchored to the foundation with anchor bolts spaced a maximum of 6 feet on center.

Foundation anchorage
R403.1.6

- There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches or less from each end of the plate section.



Foundation anchorage
R403.1.6

- There must be a minimum of two bolts per sill plate section.
- 6 Ft. O.C. and 12" at the corners.

Foundation anchorage
R403.1.6

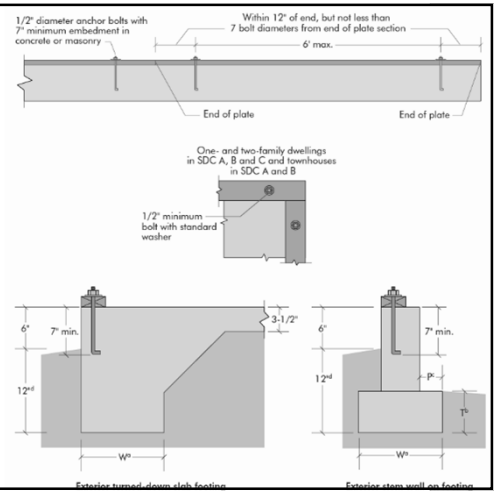
- Bolts should be at least 1/2 inch in diameter and should extend a minimum of 7 inches into the concrete or masonry foundation.
- A nut and washer is required on each bolt to hold the plate to the foundation.

Foundation anchorage
R403.1.6

- Masonry stem walls 48” or less in length that support any braced wall panels (BWP) shall be reinforced per R602.10.5.3
- This includes stem walls supporting any BWPs including the portal frame (PF) bracing method.

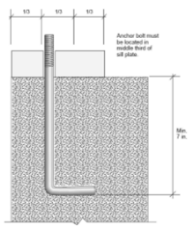
Foundation requirements for continuous footings

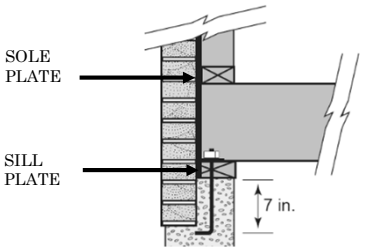
(turned-down slab edge, thickened slab, masonry or concrete foundation wall)



Foundation anchorage
R403.1.6

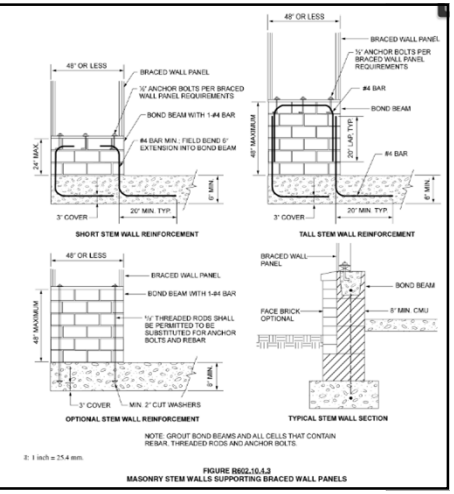
- Anchor Placement





Stem Walls

- The reinforcement details in Figure R602.10.4.3 are appropriate for masonry stem walls that are up to 4 feet in length and not more than 4 feet in height.



Stem Walls

- If the masonry stem walls are taller than 4 feet, an engineered design of the reinforcement is required.

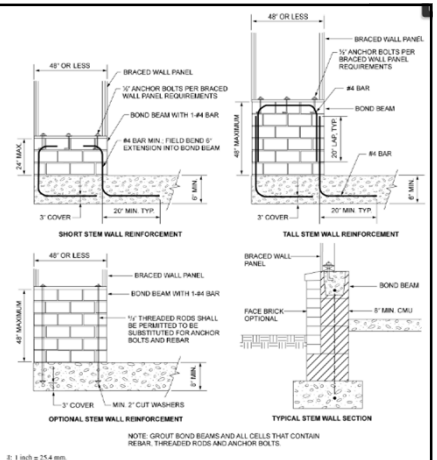


FIGURE R602.10.4.3
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

Roof Connections

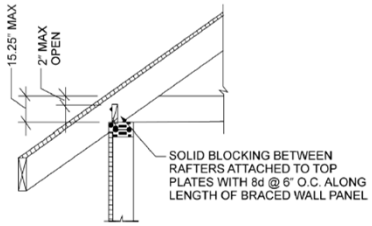


FIGURE R602.10.4.5(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

Potential structural problems with roof ventilation and/or if no protective finish is provided.

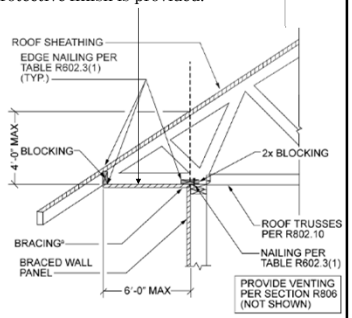


FIGURE R602.10.4.5(2)
ALTERNATE TO FIGURE R602.10.4.5(1)
OR FIGURE R602.10.4.5(3)

Stem Walls

- If the masonry stem walls are longer than 4 feet, this specific reinforcement is not necessary (standard construction in accordance with section R403.1.3.2 is sufficient).

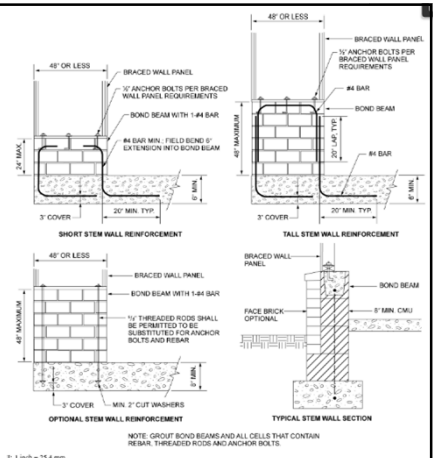


FIGURE R602.10.4.3
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

Roof Connections

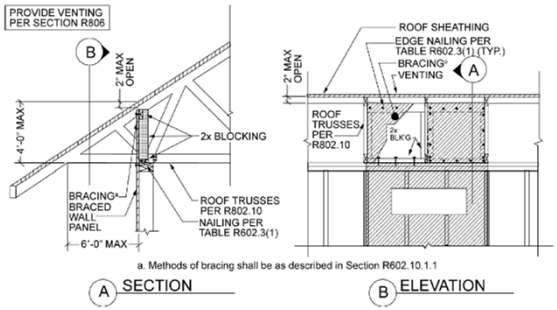


FIGURE R602.10.4.5(3)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS OR TRUSSES

May 2019

Fire Safety

Fire Safety

Primary:
Alert and Evacuate

Secondary:
Property Damage

Fire Safety

- Most US fires occur in residential buildings, particularly one- and two-family dwellings.
- These fires account for more than 80% of all deaths from fire in residential uses (including hotels, apartments, dormitories, etc.) and about two-thirds of all fire fatalities in any type of building.
- One- and two-family dwellings also account for more than 80% of residential property losses and more than one-half of all property losses from fire.

Basic Fire Safety provisions

- Smoke alarms
- Egress
- Fire Separation Distance (FSD)

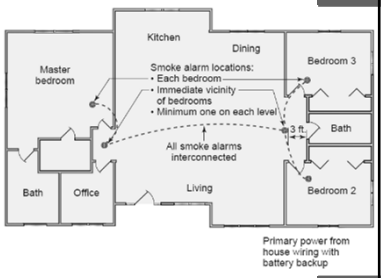
Smoke alarms

Where are smoke alarms required?

Smoke Alarms (R314.6) Power

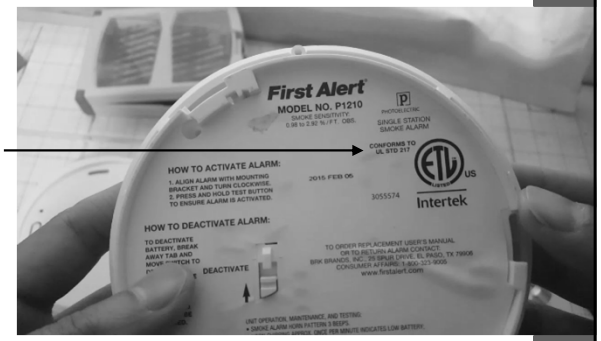
- Primary power from house wiring with battery backup.

- Each sleeping room.
- Right outside the sleeping rooms.
- Basements and habitable attics



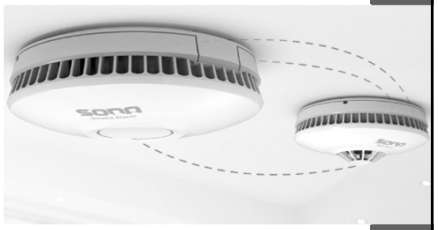
Smoke Alarms (R314.1.1) Listing

- UL 217



Smoke Alarms (R314.4) Interconnection

- Must be interconnected
- Interconnectivity may be wired or wireless.



Smoke Alarms Required (R314.2.2)

Minor Building Renovations:

- A smoke alarm is required. Battery power may be provided.
- Plumbing or mechanical work in existing dwellings also does not trigger the smoke alarm requirements.

Smoke Alarms Required (R314.2.2)

Major Renovations & interior additions:

- Permanent wiring is required.

Fire Alarms (R314.7)

- Fire alarm systems shall be permitted to be used in lieu of smoke alarms.
- Fire alarms are most often seen in combination with home security systems.

Residential Sprinklers

- Not required by the NCRC.
- Optional: Regulated by NFPA 13D or P2904.

Section R302 – Fire Resistant Construction

Residential Sprinklers Differences

13D	13R
• Quickest response. • Primarily for life safety (not property protection) • Partial coverage. (not attics, closets, bathrooms, garages, concealed spaces, etc.) • No mixed use.	• Quick-response. • Primarily for life safety (not property protection) • Partial coverage. (not attics, closets, bathrooms, garages, concealed spaces, etc.) • No mixed use.
• One- and two-family dwellings and townhouses. • Maximum three stories + attic.	• Apartments, hotels, motels, dormitories & 4 story townhomes. • Maximum four stories.
• Water supply duration. (10min). • Domestic water supply, a water well, an elevated storage tank, or approved tank allowed (or any combination). • No backflow device.	• Water supply duration. (30 min) • Approved water pressure & Backflow device.
• PEX and CPVC pipe allowed.	• CPVC and metallic pipe allowed.

Fire Separation Distance (FSD)

See Ch.2 Definition

- Limits the spread of fire to protect property and occupants
- Provides time for fire-fighting.

Exterior wall protection (R302.1)

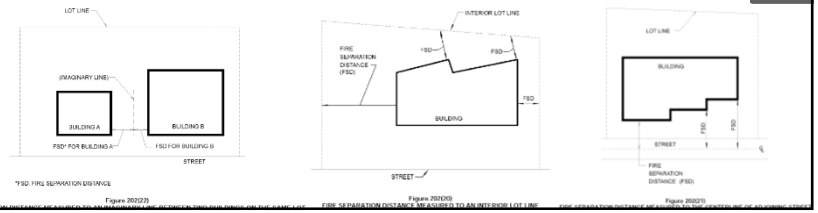
- Exterior walls or projections:

  < 3 ft. = 1 hr. req.

- Windows or doors:

  .

  < 3 ft. = not permitted



Basic building requirements for Accessory Dwelling Units and Temporary Health Care Structures:

ADU

- Attached ADU: This setup is similar to a duplex with no connectivity between units. 1 hr. fire separation is required and a separate address shall be required.
- Detached ADU: Is considered a second building in the same lot. A 3'-0" min. fire separation distance is required.
- Connected ADU: An ADU directly connected to the main structure (door or stair) is considered an extension of the primary residence and no fire separation is required.

Temporary health care structures

- The unit must be assembled off-site and built to the standards of the State Building Code for Manufactured Homes. It must be no more than 300 gross square feet. It can NOT be placed on a permanent foundation.

Accessory Dwelling Units and Temporary Health Care Structures

- Building Code requirements are completely different from zoning requirements.

Basic <u>zoning requirements</u> for Accessory Dwelling Units and Temporary Health Care Structures.

- **ADU**

A second dwelling unit located within the principal detached dwelling or within a separate accessory structure. The unit must include both kitchen and bathroom facilities and be intended for use as a year-round residence. Other restrictions apply when located in a mixed-use development, within a principal single family home, or within an accessory structure.

- **Temporary health care structures**

A manufactured home placed on a single family home lot. Must be owned or occupied by a qualified care-giver and the accessory structure is occupied only by the impaired person. The accessory structure must comply with all setbacks and any maximum floor area ratio limits that apply to the primary residential structure. The structure may be required to connect to any water, sewer, and electric utilities serving the property. Only one accessory temporary family care structure is allowed per lot. Other zoning requirements that are applicable to all other accessory structures in that zoning district may also be applied. No signage regarding the presence of the structure is allowed. The structure must be removed within 60 days after care-giving on the site ceases.

Soffit Protection
R302.1.1

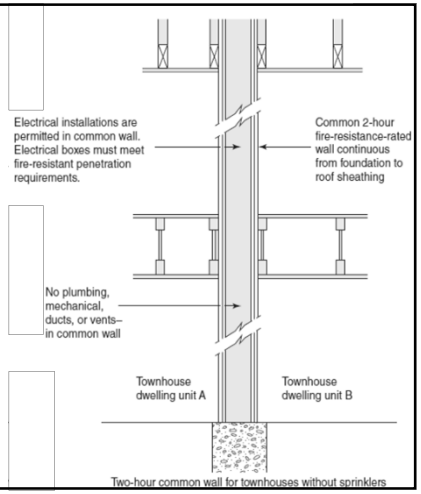
- Soffits with a FSD <3 ft. Require one-hour fire protection on the underside.
- Soffits with a FSD <10 ft. Must be protected per sections R302.1.1 & R302.1.2.

Acoustical Fire Caulk

- **Question: Is acoustical fire caulk allowed?**
- **Answer:** YES. Acoustical sealant is often applied on area separation walls to create an air barrier.
- An air barrier is an optional feature on Area Separation Walls designs. It prevents air leakage, noise transmission, air whistling and dust collection.

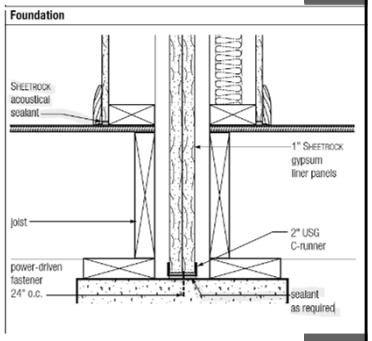
Townhomes
R302.2

- 2 hr. continuous separation (foundation to roof) required between unsprinklered townhomes.
- Electrical installations are allowed on the common wall.
- Plumbing or mechanical equipment, ducts or vents are NOT allowed on the common wall.



Acoustical Fire Caulk

- **Question: Where can acoustical fire caulk be applied?**
- **Answer:** A bead of sealant can be applied around any membrane penetration in the wood studs, the partition perimeter or between wood the gypsum board panels. It can also be applied under the foundation runner or the head of wall. Some sealant are also approved for membrane penetrations.



Townhouse Roof protection:

Options:

1. A 30-inch-high parapet (2hr. rated).

2. Fire protection for a distance of 4 feet on each side of the separating wall.

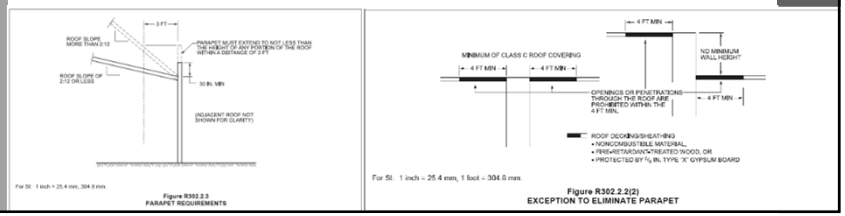
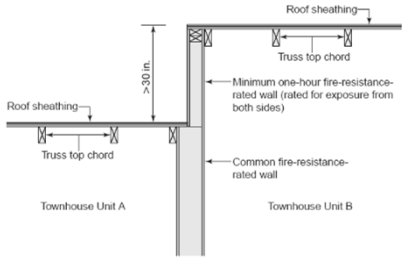


Figure R302.2.3
PARAPET REQUIREMENTS

Figure R302.2.2(2)
EXCEPTION TO ELIMINATE PARAPET

Townhouse roof separation (R302.2.2.2 - #3)

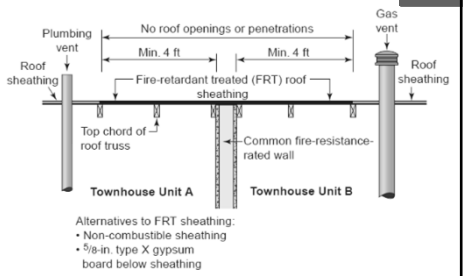
- Townhouse separation for roofs with greater than 30-inch height difference.



Townhouses without parapets

Roof penetrations are prohibited within 4 ft. of the separating wall:

- Skylights
- Roof windows
- Gas vents
- Plumbing vents
- Exhaust outlets
- Air intakes
- Ridge vents
- Roof vents



Roof protection

For townhouses without parapets, roof penetrations are prohibited within 4 ft. of the separating wall:

- Skylights
- Roof windows
- Gas vents
- Plumbing vents
- Exhaust outlets
- Air intakes
- Ridge vents
- Roof vents •

Additional Soffit Protection for Townhomes. (R302.2.5)

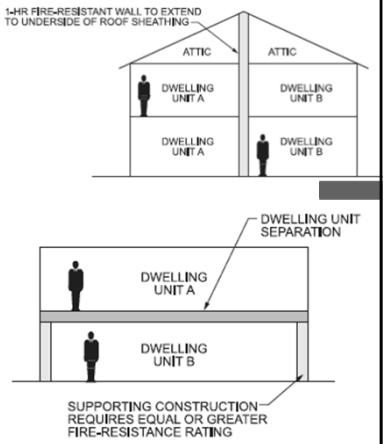
- Wood sheathing is ¾" (not $^{23}/_{32}$").
- Vents are not allowed within 4 ft. of fire walls.

Duplex separation

R302.3

(horizontal or vertical)

- One-hour fire-resistance-rated separation between the dwelling units of a two-family dwelling, continuous to the exterior walls or roof.



Overhang Protection for Townhomes. (R302.2.6)

Up to 12" overhangs may encroach the property line if:

1. The rated wall is tight to the roof deck.

2. Eaves are non-combustible or FRT.

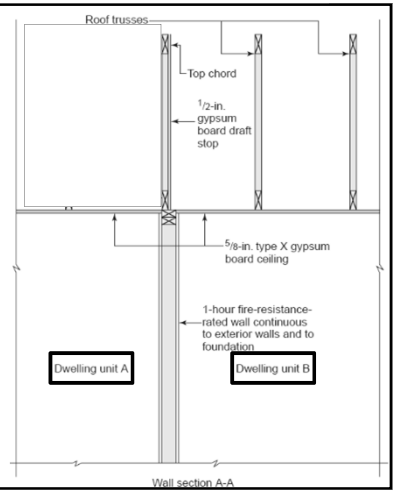
3. Eaves have 5/8" Type X GWB or equivalent on the underside.

Duplex separation alternative

- ⅝-inch Type X gypsum board ceiling & the framing supporting the ceiling is protected with ½" gypsum.

  AND

- A½-inch gypsum board draft stop in the attic area.



Through Penetrations (R302.4.1)

Exceptions:

- 1. Concrete grout or mortar can be used in on concrete or masonry walls.
- 2. Materials per ASTM 119 or UL 263.

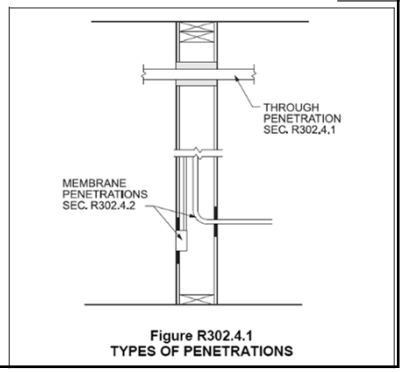


Figure R302.4.1
TYPES OF PENETRATIONS

Membrane Penetrations (R302.4.2)

Exceptions:

- 1. Concrete grout or mortar can be used in on concrete or masonry walls.
- 2. Approved materials per ASTM 119 or UL 263.

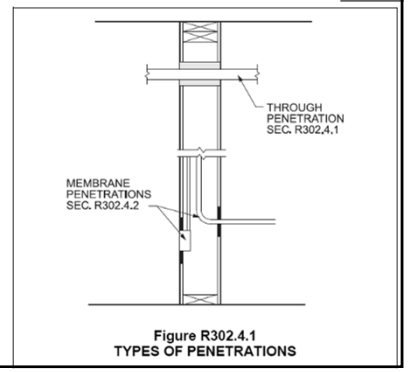


Figure R302.4.1
TYPES OF PENETRATIONS

Through Penetrations (R302.4.1)

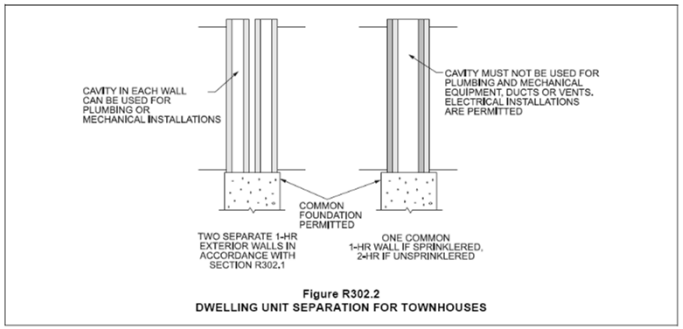


Figure R302.2
DWELLING UNIT SEPARATION FOR TOWNHOUSES

Electrical box penetrations. R302.4.2

- NOTE: Not applicable to area separation walls.

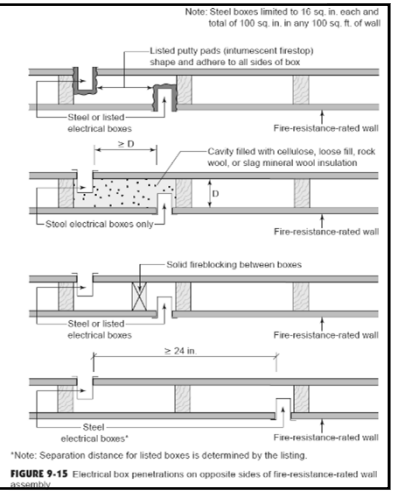
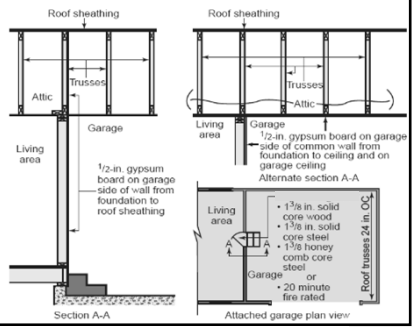


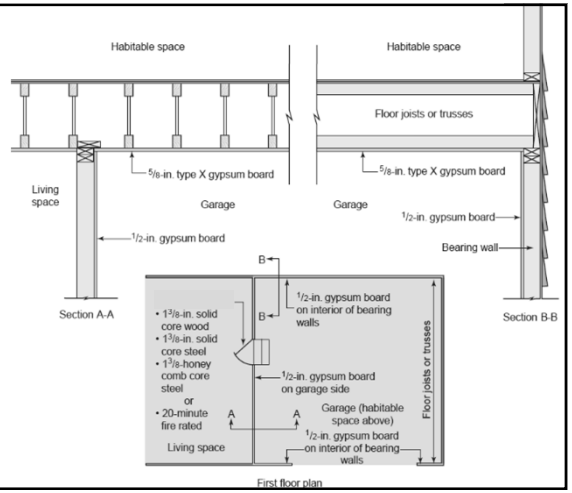
FIGURE 9-15 Electrical box penetrations on opposite sides of fire-resistance-rated wall assembly

Dwelling-garage fire separation. R302.6

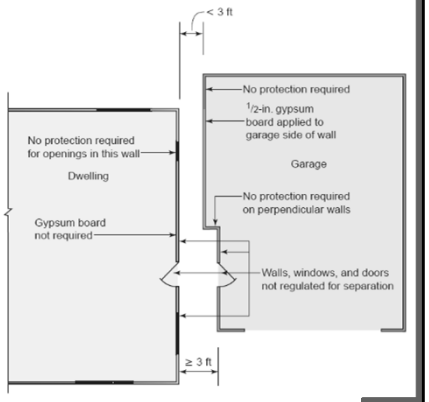
- ½-inch GWB required.
- ⅝-inch Type X GWB ceiling if there is a habitable room above.
- The ceiling's bearing walls require ½-inch GWB on the interior surface.
- Sleeping rooms require 20-min. door or approved equivalent.



Dwelling-garage with habitable space above. R302.6

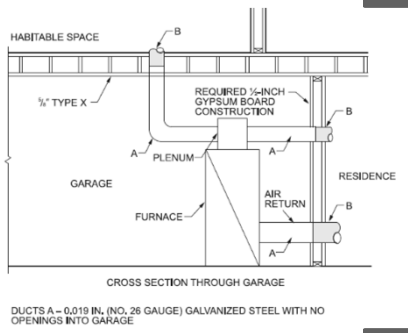


Dwelling-garage less than 3 ft. away, on the same lot. R302.6



Dwelling-Garage Ducts R302.5

No. 26 ga. minimum.



Under Stair Protection (R302.7)

- Open storage = no protection.
- Enclosed storage = ½" GWB required on the enclosed side.

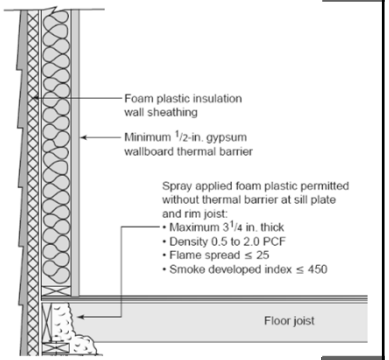
Flame Spread Index R302.9

- Class C required.
- Does not apply to picture mold, chair rails, baseboards , handrails, wallpaper etc.

Foam Plastic (R16.4)

Must be isolated from the dwelling by a ½" GWB or an equivalent thermal barrier.

- See exceptions for attics and crawlspaces R316.5.3 & R316.5.4. entered only for maintenance or repairs



Insulation R302.10.1

- Insulation, including facings used as vapor retarders or as breather papers, must be class A.
- If the paper is in contact with a material, there is no airspace to pose risk and Class A is not required.
- Cellulose insulation is regulated by CAN/ULC S102.2, SDI must be < 550.
- Plastics are regulated by R316.

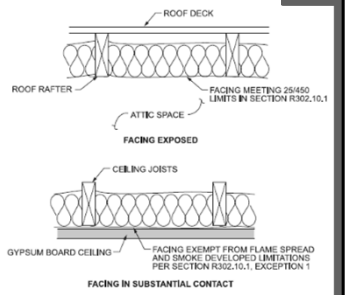
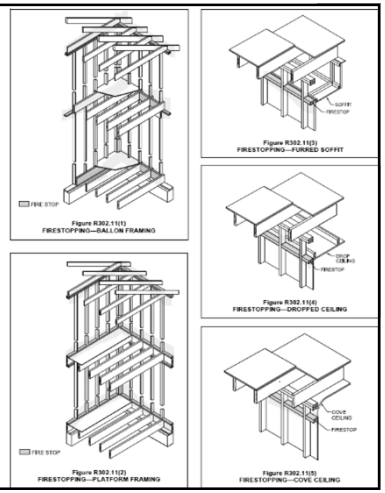


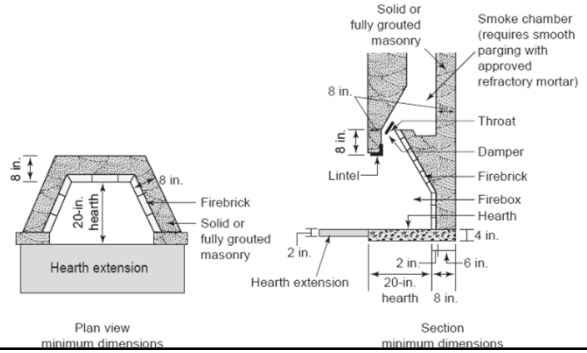
Figure R302.10.1
INSULATION FACING

Fireblocking R302.11

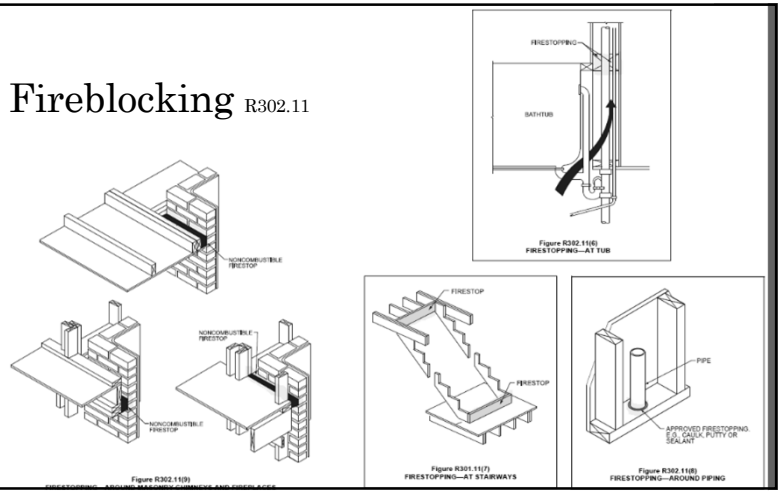
- Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.



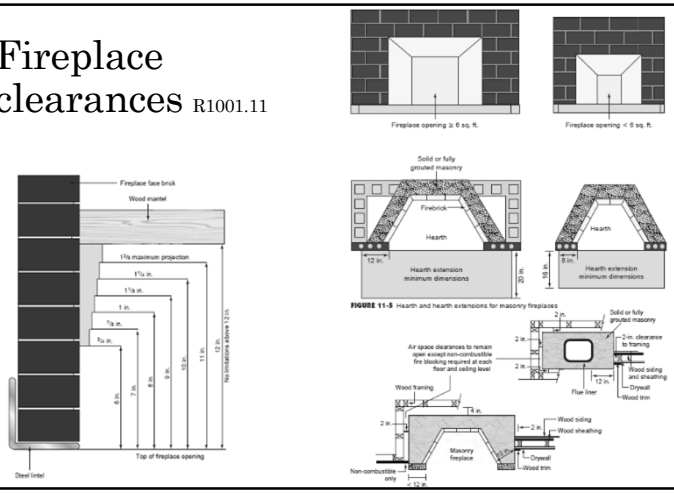
Fireplace Hearth Extensions R1001.9



Fireblocking R302.11

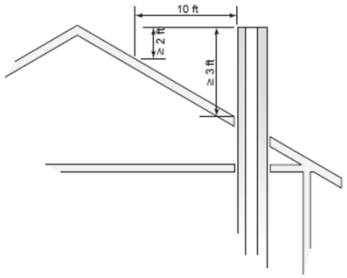


Fireplace clearances R1001.11



Chimney termination R1003.9

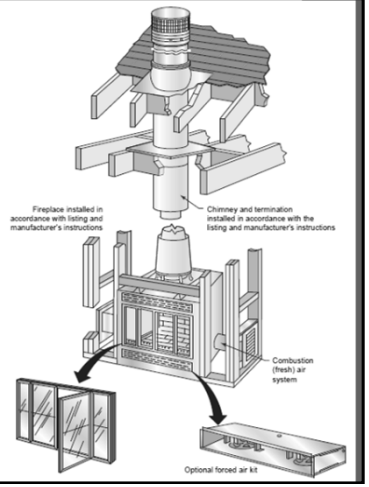
- The requirements of this section shall apply as well to outdoor chimneys in proximity to the home.



Manufactured Fireplaces & Chimneys

R1004, R1005

- Listed per UL 127.
- Hearth extension per manufacture's specifications.
- 30 degree max. offset.
- No more than 4 elbows.



Chimney termination R1003.9

Roof Slope	Height
12:12	½ of width
8:12	⅓ of width
6:12	¼ of width
4:12	⅙ of width
3:12	⅛ of width

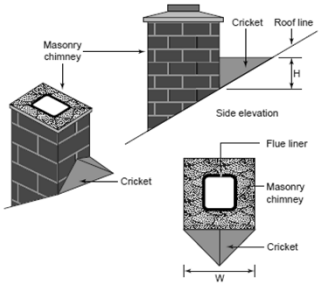
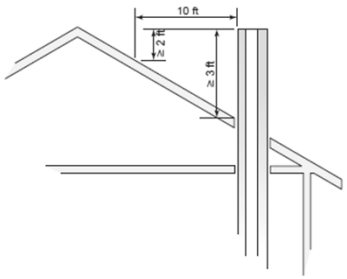


FIGURE 11-9 Cricket dimensions



Firestop

R1004, R1005

Q: The flue manufacturer states that you can't put firestopping caulk at ceiling levels. Because expansion and contraction is necessary. Do we leave an opening ?

A: The manufacturer is correct per UL 127-7.3 an opening is required.

However, per UL 127- 7.1.4. **" The construction of a fireplace shall not void the firestopping required between spaces of a building when the fireplace and its chimney are installed in accordance with the manufacturers instructions."**

So what can we do? We may use rockwool. It is non-combustible and allows expansion and contraction.

NOTE: Review the manual. Some appliances may require 1- 36 inches of clearance to combustible materials.

Questions?
(any topic)

June 2019

Building Planning

1. Room Areas

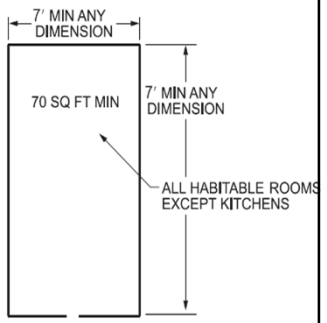
Minimum area
R304

Overcrowding creates unhealthy and unsafe living conditions, such as:

- Moisture accumulation.
- Odors.
- Disease transmission.
- Inadequate ventilation.

Minimum Dimensions
R304.1, R304.2

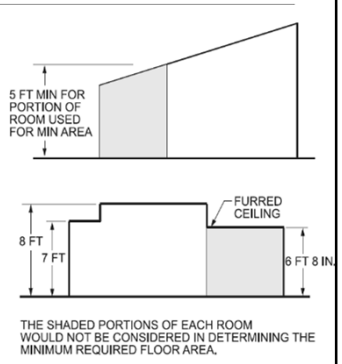
- **70 sf.** min. for habitable rooms other than kitchens. (new).
- The smallest dimension shall be **7 ft. min.** (except kitchens).



Room Size Calculation
R304.3

Portions not included in the calculation:

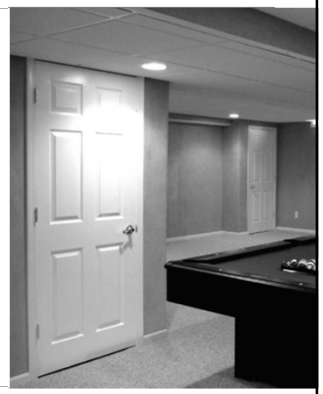
- Sloped ceilings, ceilings under **5 ft.**
- Furred ceilings measuring less than **7 ft.**



Min. Ceiling Height
R305.1

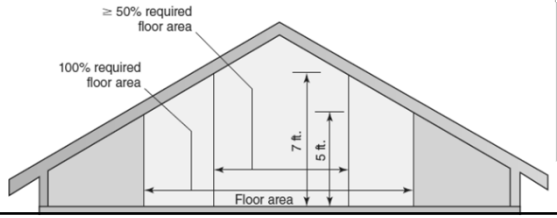
(NEW)

- Habitable spaces and hallways: **7'-0".**
- Bathrooms, toilet rooms and laundry rooms: **6'-8".**



Sloped Ceilings
R305.1 exception #1

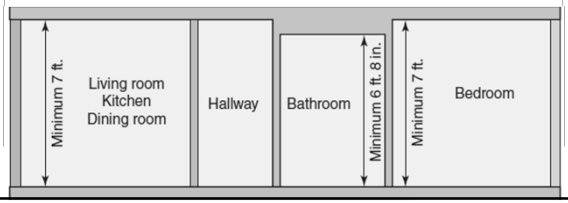
- Half of the required room area must be 7'-0" high.
- The ceiling height shall be no less than 5'-0.



Bathrooms and Showers
R305 exception #2

(NEW)

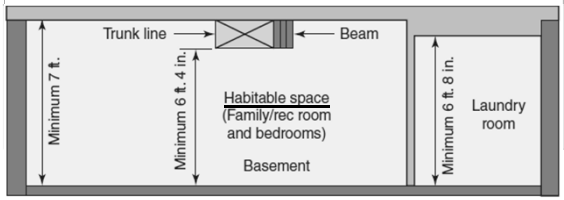
- **The ceiling height above bathroom and toilet room fixtures** shall be such that the fixture is capable of being used for its intended purpose.
- **A shower or tub with a showerhead** shall have a ceiling height of not less than **6'-8"** above an area of not less than **30" by 30"** at the showerhead.



Non-habitable spaces and basements

R305.1.1 exception #3
R305.1.1 exception

- **Beams, girders, ducts or other obstructions** in *habitable spaces* shall be permitted to project to within 6′-4″ of the finished floor.
- **Portions of *basements* that <u>do not</u> contain *habitable space* or hallways** shall have a ceiling height of not less than 6′-8″.
  - **At beams, girders, ducts or other obstructions,** the ceiling height shall be not less than 6′-4″ .



2. Means of Egress

Exterior egress door

R311.2

- One 3′-0″ x 6′-8″ (nominal) exterior door.
- Side-hinged.
- No double keyed deadbolt.
- Shall not pass through the garage.

Exterior egress door

R302.7, R311.1

NC Department of Insurance
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919-647-0000

Double Door Exits

Code: 2018 Residential Code **Date:** March 21, 2019
Section: R311.2

Question:
Are double doors permitted for the required exit if they have a total door opening equal to 36 inches?

Answer:
Yes. These doors are typically two 30-inch doors or two 32 inch doors. They can not have a stationary center mullion, but one leaf can have a toe and/or head bolt. The other leaf must be readily openable from the egress side without the use of a key or special knowledge or effort.

Exterior egress door
R302.7, R311.1

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Exterior Egress Door Dimensions

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R311.2

Question:
Section R311.2 specifies the requirements for the minimum dimensions of at least one exterior egress door, but other exterior doors are not required to comply with the minimum dimensions. Are other exterior egress doors required to meet any minimum dimensions?

Answer:
Yes. Exterior egress doors, in addition to the one required, must meet the 78 inch minimum height requirement but are not required to meet the 32 inch minimum width. This minimum height dimension is required to be maintained in exterior egress doors to provide the inherent feeling of safety that a door utilized for egress should afford. Other exterior doors, such as a balcony access or ornamental opening, utilized in non-egress applications that are not intended for use in the evacuation of an occupied space are not required to meet the minimum dimensions.

Floors and Landings at exterior doors
R311.3

- There shall be a landing or floor <u>on each side</u> of each exterior door.
- The width of each landing shall be not less than the door served.
- Every landing shall have a dimension of not less than 36" measured in the direction of travel.
- The slope at exterior landings shall not exceed 1/4 unit vertical in 12 units horizontal (2 %).

Floors and Landings at exterior doors
R311.3 exception

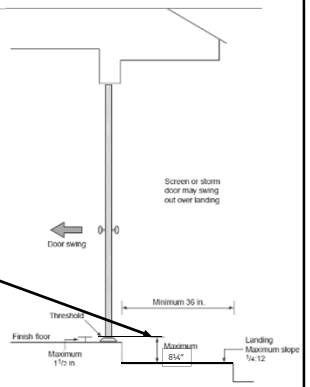
French balcony exception:

R311.3 Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall be not less than the door served. Every landing shall have a dimension of not less than 36 inches (914 mm) measured in the direction of travel. The slope at exterior landings shall not exceed $^1/_4$ unit vertical in 12 units horizontal (2 percent).

Exception: Exterior balconies less than 60 square feet (5.6 m²) and only accessible from a door are permitted to have a landing less than 36 inches (914 mm) measured in the direction of travel.

Landings at exterior egress doors
R311.3

- Required on <u>both sides</u> of the door.
- The landing must be as wide as the door & 36" deep min.
- A step down is allowed **IF** the door swings in.

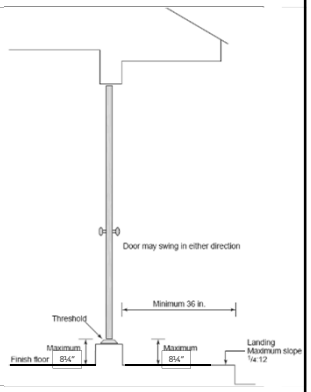


Exception: The exterior landing or floor shall be not more than $^7/_8$ inches (210 mm) below the top of the threshold provided the door does not swing over the landing or floor.

Landings at exterior non-egress doors
R311.3.2

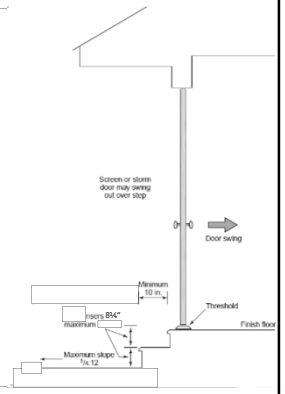
At non-egress doors:

- The floor or landing on either side of the door is permitted to be 8 ¼" inches below the top of the threshold.
- The door may swing in either direction



Landings at exterior non-egress exterior doors
R311.3.2 exception

A landing is not required outside **IF t**he door swings in.



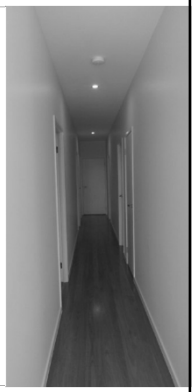
Storm & screen doors
R311.3.3

Storm and screen doors shall be permitted to swing over exterior stairs and landings.

Means of egress
R311.6

Hallways:

- The width of a hallway shall be not less than **3 ft**. measured from the finished surface of the walls.



Means of egress
R311.6.1

Interior egress doors:

- Size: **2′-6″ x 6′-8″** (nominal)
- Readily openable (i.e. no double-keyed dead bolts).

Q:
What's the difference between a hallway and a cased opening?

A:
A cased opening has a 12″ max. depth per MCCE.

Hallway: 3′-0″ min.

Cased opening: 2′-6″ max. up to 12″ deep.

Means of egress
R311.6

Stairs:

- The code requires limited **½″ gypsum** protection on the underside of stairs when the space below is enclosed.

Stairs rise
R311.7.3, R311.7.5.1

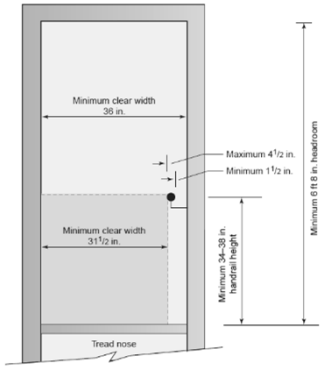
- Vertical rise **12′-3″** max. with no landings.

Stairway width and height.
R311.7.1

Stairway width (wall to wall):
- Egress stairways shall be **36" wide.**
- Non-egress stairways shall be permitted to be **26" wide.**

Stairway width (between handrails):

- The min. width between one handrail and the wall is **31 ½".**
- The min. width between two handrails is **27".**



Stairs
R311.7.1

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919-647-0000

Projections on Stairway Walls

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R311.7.1

Question:
In one- and two-family dwellings may items other than railings, which are specifically addressed in R311.7 .1, be mounted on stairway walls and ceilings?

Answer:

Yes, with limitations. Elements such as trim, stringers or other items may be on the wall below the handrail or handrails as long as they do not exceed projection limits allowed for handrails. These items must not reduce the required clear stairway dimension allowed for handrails. Similarly, elements may project into the stairway above the 6 feet 8 inches requirement of Section R311.7.2. See 2015 IRC commentary Figure R311.7.1 attached below. The allowed projection areas are shaded.

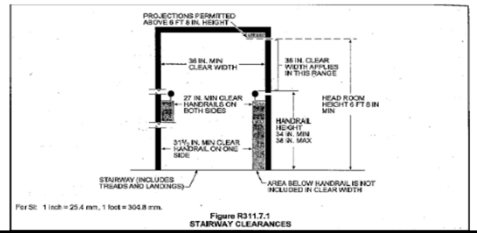
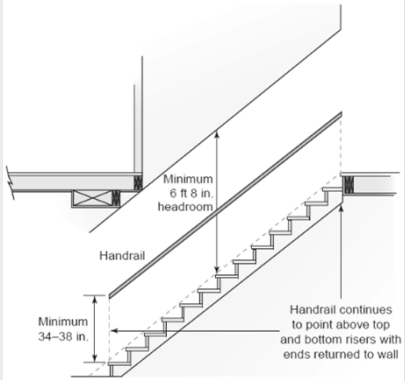


Figure R311.7.1
STAIRWAY CLEARANCES

Stairway headroom
R311.7.2

The min. 6′-8″ includes the flight of stairs and the landings serving the stairway.



Stairway headroom and handrail height
R311.7

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919-647-0000

Fixed Stairway Upper Landing Headroom

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R311.7.2

Question:
What is the headroom requirement for the area at the top of a permanent stairway? The stairway does not have a door at the top.

Answer:
Section R311.7.2 defines headroom requirements for stairways. It states:
"The minimum headroom in all parts of the stairway shall not be less than 6 feet, 8 inches."

"All parts" of the stairway includes landings. Therefore, there should be a minimum floor area of 36"x36" at the top of the stairway with a minimum headroom of 6'-8". These clearances are minimums that are required for safety of the occupants for egress and for fire fighting personnel to access the space.

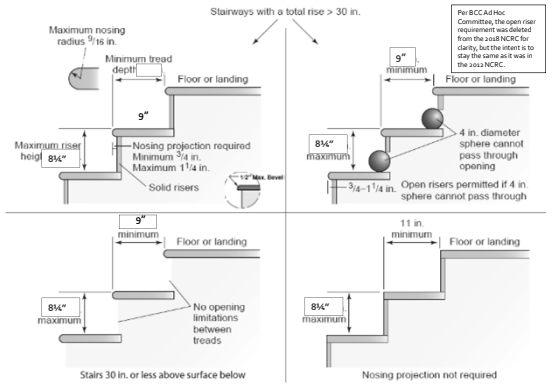
Stairway headroom

R311.7.2 exception #1

- This exception allows us to have a ceiling offset of **4 ¾"** maximum, without being considering it a projection into the required stairway headroom.
- This exception only applies at the side of stairs.

Stair treads, risers and nosings.

R311.7.5

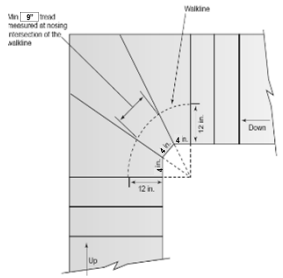


Walkline

R311.7.4

Deleted

- Section R311.7.4 Walkline, was deleted from the NCRC.
- Because sections 311.7.5.2.1 (winder threads) and section R311.7.10.1 (spiral stairways) continue to reference the walkline we must borrow the definition from the NCBC.



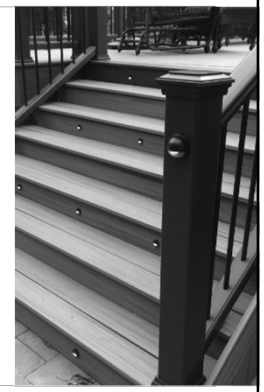
R201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have the meanings ascribed in other code publications of the North Carolina Building Code Council.

Exterior plastic composite stair threads

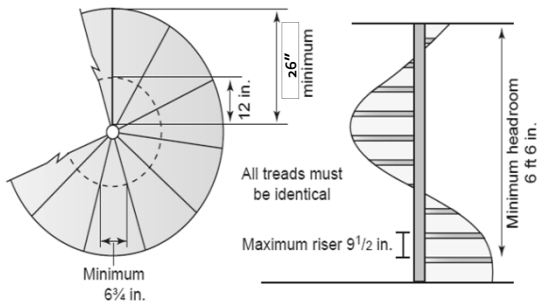
R311.7.5

NEW

In addition to the requirements of Section R311.7.5, stair treads made of wood/plastic composite materials must be installed and labeled per ASTM D7032.



Spiral stairways
R311.7.10.1



Bulkhead enclosures
R311.7.10.2

This section exempts exterior bulkhead enclosure stairways (non-egress) from the landing stairway and handrail requirements.

Mezzanines
R325

NEW

Mezzanine section.

The requirements are similar to the commercial code.

Bowed thread stairways
R311.7.10.3

- At no point shall the tread be less than **9".**
- Each bowed tread is uniform with other bowed treads with no more than **3/8-inch** variance.

Ship's ladders
R311.7.12

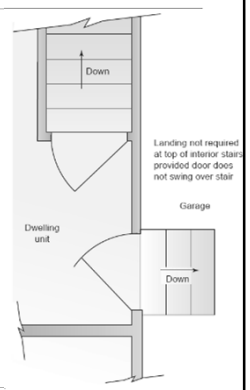
- A ship's ladder cannot be used as an element of a means of egress.
- Must be at least 20" wide, as measured at and below handrails.
- Handrails shall be provided on both sides, be continuous and graspable, per code.

Ramps
R311.8

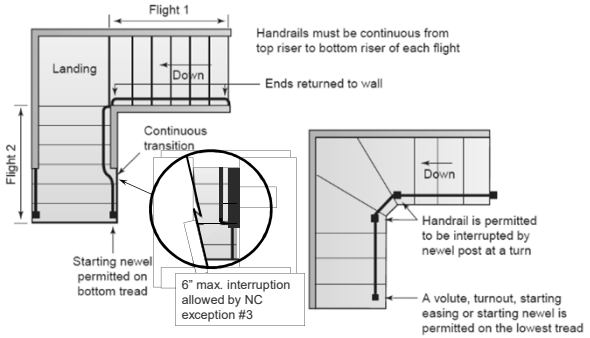
- Section R311.8 states the code requirements for ramps when they are used to access, or are located, within a dwelling.
- Egress ramp: 1:12 slope , two handrails.
- Non-egress ramp: 1:8 slope one handrail. (new)
- Landings are 36" min. in the direction of travel.

Interior landings
R311.7.6

- A floor or landing is required at the top and bottom of stairs.
- An exception to the landing requirement allows a door at the top of an interior flight of stairs, provided the door does not swing over the step.

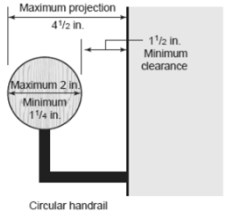


Handrail Continuity
R311.7.8



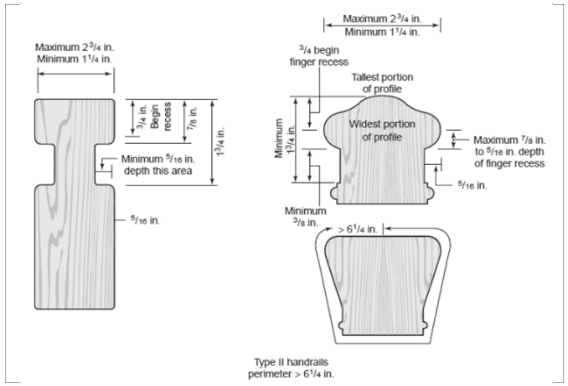
Handrail shapes and graspability.
R311.7.8

- Handrails must be securely anchored to resist a single concentrated load of 200 pounds applied in any direction.
- Any shape, type or size of handrail the equivalent graspability can be accepted.



Handrail shapes and graspability.
R311.7.8

Other shapes, types or sizes equivalent in graspability could be accepted.



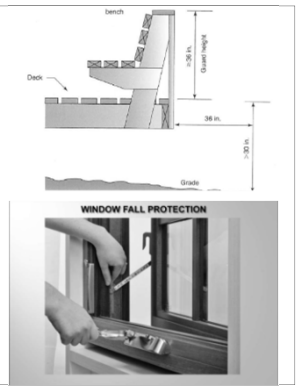
3. Fall protection

Guards
R312.1

Section Reorganized.

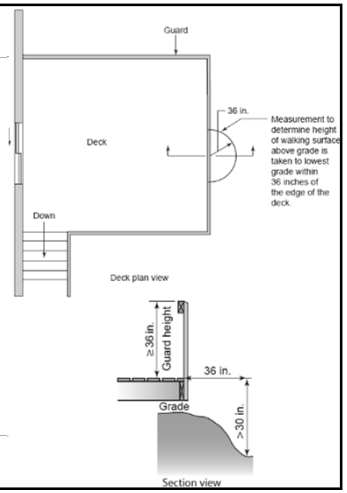
Guards no longer required at fixed seating.

Window sill requirements relocated and better defined.



Guards
R312.1

The code requires a minimum 36-inch-high guard as protection against falling from a walking surface to a lower surface that is more than 30 inches below.



Guards
R312.1

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919-647-0000

Guards On Retaining Walls

Code: 2018 Residential Code **Date:** April 10, 2019
Section: R404.4

Question:
When are guards required on retaining walls?

Answer:
Section R404.4 requires engineering design for the following residential retaining walls and are therefore required to be permitted and inspected:

1. All retaining walls with an unbalanced condition exceeding 48 inches
2. All retaining walls that cross over property line
3. All retaining walls that support buildings and their accessory structures.

Section R312.1.1 states in part; "Guards shall be located along open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches (762 mm) measured vertically to the floor or grade below…." The Commentary for Section R312.1 states: "The guard provisions of this code address the issue of providing protection for occupants from falling off of any elevated walking surface."

Guards complying with R312 must be included on any of the above mentioned retaining walls when the finished area on the high side of the wall is more than 30 inches above the grade below and part of an egress route or other dedicated walking surface.

Guards
R312.1

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919-647-0000

Guard Rails on Screened Porches

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R312

Question:
On a screened porch that has a floor more than 30" above the adjacent grade, are horizontal or vertical members required to prevent the passage of a 4" sphere?

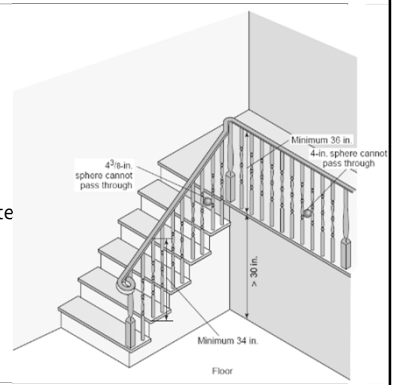
Answer:
Section R312.1.2 requires that a guardrail shall be a minimum of 36 inches in height above the walking surface. Section R312.1.3 requires that vertical pickets be spaced less than 4 inches apart. The guardrail is installed to prevent people or large objects from falling to the floor or grade below. The pickets are installed to prevent children or small objects from passing through the guardrail.

Screen may be accepted in accordance with Section 105 of the NC Administrative Code as an alternate method to replace the pickets provided all of the following conditions are met:

- Guardrails shall be installed horizontally at 36 inches and 18 inches above the walking surface.
- Guardrails shall be capable of resisting a 200 pound concentrated load applied in any direction at any point along the rail (ref. Table R301.5).
- The screen and the screen attachment shall be capable of resisting a 50 psf uniform live load (ref. Table R301.5) from the direction of the protected raised walking surface.

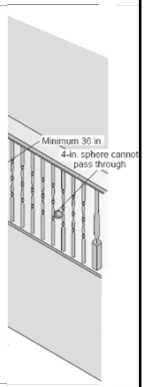
Guards
R312.1

At the sides of stairs, the minimum guard height is reduced to 34 inches to correlate with the minimum handrail height.



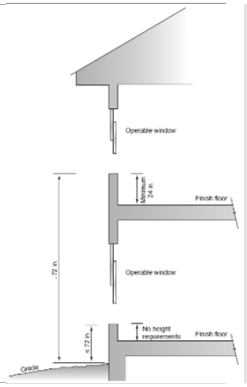
Guards
R312.1

Guards also must be constructed in such a way that a 4-inch sphere will not pass through



Window-sill height
R312.2

- Fall protection can be achieved by installing a barrier or limiting the dimensions of the window opening.
- ASTM F 2090 regulates both window opening control devices and window fall prevention devices.



Window-sill height
R312.2

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

Window Sill Height Measurement to Porch Roof

Code: 2018 Residential Code **Date:** May 2, 2019
Section: R312.2.1

Question:
Is a porch roof that is less than 6 feet below a second story window considered a "surface below" for purposes of applying Section R312.2.1 – Widow Sills?

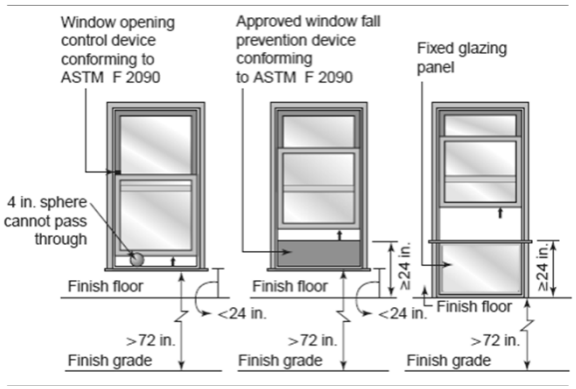
Answer:
Yes, if the porch roof has a slope of 1:48 slope or less and the porch roof is 3 feet wide. If the porch roof either has a slope greater than 1:48 or has a width less than 3 feet, then it is not considered a "surface below".

Explanation:
Section R312.2.1 is intended to prevent small children from falling vertically from a window more than 6 feet to a surface below. Apparently, a distance more than 6 feet is considered by the code to be an unsafe distance for children to fall.

A porch roof with a slope of 1:48 or less (1/4" fall in a 12" run) could be considered such a surface. Since the roof surface is almost horizontal except for the 1:48 drainage slope it is unlikely that a child that fell from the window would continue to roll; so, the fall should terminate at the porch roof if the roof surface is sufficiently wide.

Section R312.1.1 will require a guard where there is a drop of 30 inches or more measured to a horizontal point within 3 feet of the upper walking surface. Since the opening requirements of Section R312.2.1 are intended to act as a guard, it appears reasonable to apply the 3-foot horizontal distance to the porch roof (see Figure A). The porch roof should, therefore, be a minimum of 3 feet wide to be considered a "surface below" the window.

Alternatives to the 24" window sill height.
R312.2

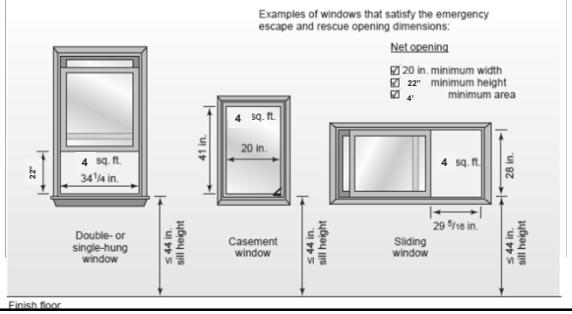


Emergency escape and rescue windows
R310.2.1

R310.2.1 Minimum opening area. Emergency and escape rescue openings shall have a minimum net clear openable area of 4 square feet (0.372 m2). The minimum net clear opening height shall be 22 inches (558 mm). The minimum net clear opening width shall be 20 inches (508 mm). Emergency escape and rescue openings must have a minimum total glazing area of not less than 5 square feet (0.465 m2) in the case of a ground floor level window and not less than 5.7 square feet (0.530 m2) in the case of an upper story window.

Emergency escape and rescue windows
R310.2.1

- Total glazing @ **grade floor** : **5.0 s.f.**
- Total glazing @ **upper story**: **5.7 s.f.**



Emergency escape and rescue windows
R310.2.1

NC Department of Insurance
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919-647-0000

Emergency Escape and Rescue Opening Minimum Size

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R310.2.1

Question:
What is the difference in the 4.0 square feet minimum net clear opening requirement and the minimum glass area requirement for emergency escape and rescue openings?

Answer:
The 4.0 square feet minimum net clear opening refers to the opening required when the sash is in the fully open position. This opening is expected to be used by the occupant for emergency escape.

The 5.0 and 5.7 minimum glass area requirement is the size of the window opening when all the sashes are removed. This opening size is based on the minimum required opening for a rescue worker to enter and remove an occupant. Also, it expected that the rescue worker has the equipment required to knock the sash(s) out for access. The 5.7 square feet opening size for the second and third floors is to account for the additional area needed to dismount a ladder and enter the opening.

Emergency escape and rescue windows
R310.2.1

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

Emergency Escape and Rescue Opening for Casement Windows

Code: 2018 Residential Code **Date:** April 5, 2019
Section: R310

Question:
A particular casement window unit has two swinging sashes and one fixed pane between the two swinging sashes. At least one of the swinging sashes meets the code requirements for minimum height or width and net clear opening for an emergency escape and rescue opening. The mullions between the swinging sashes and the fixed pane are not vertical load bearing. Can the window unit as a whole be considered in the 5.0 sq. ft. first floor and 5.7 sq. ft. upper story glass area requirement or does each swinging sash or fixed pane have to be considered separately?

Answer:
The window unit can be considered as meeting the 5.0/5.7 sq. ft. requirement if in the estimation of the local inspector the mullion between the swinging sash and the fixed pane can be knocked out with a fireman's ax with no more effort than would be required to knock out a sash of a double hung window.

This interpretation would also apply if the window were just two swinging sashes without a glass pane separating the two sashes.

Emergency escape and rescue windows
R310.2.1

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

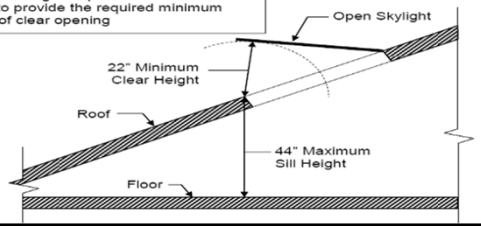
Skylights Used as Emergency Escape and Rescue Openings

Code: 2018 Residential Code **Date:** April 9, 2019
Section: R310

Question:
Can skylights that meet the requirements of Section R310 be used as emergency escape and rescue openings?

Answer:
Yes. The minimum opening height, width, and area must be available with the skylight in the open position (see sketch below).

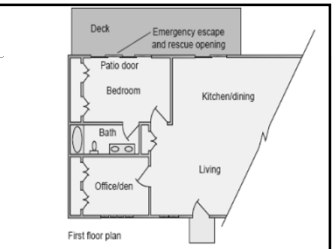
EXAMPLE of OPENING DIMENSIONING:
22" clear height requires a 37 ½" clear width to provide the required minimum 5.7 sf of clear opening

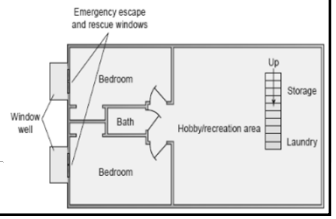


Emergency escape and rescue location
R310.2

Required in:

- Basements
- Every sleeping room.
- Habitable attics.



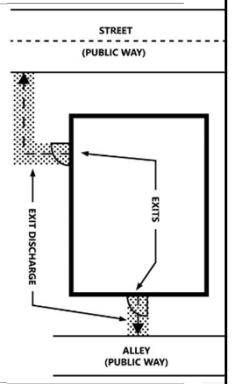


Emergency escape and rescue openings
R310.2.2, 310.2.5, R310.6

- Reorganized.
- New exceptions for basements.
- Window wells required.
- Doors 22" are allowed as em. egress.

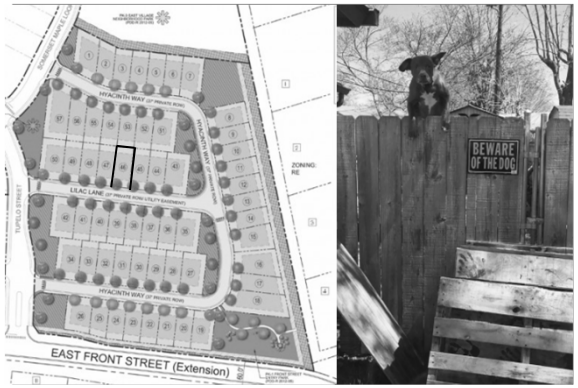
Public Way
R310

The required egress door shall open directly into a public way, yard or court that opens to the public way.



Public Way
R310

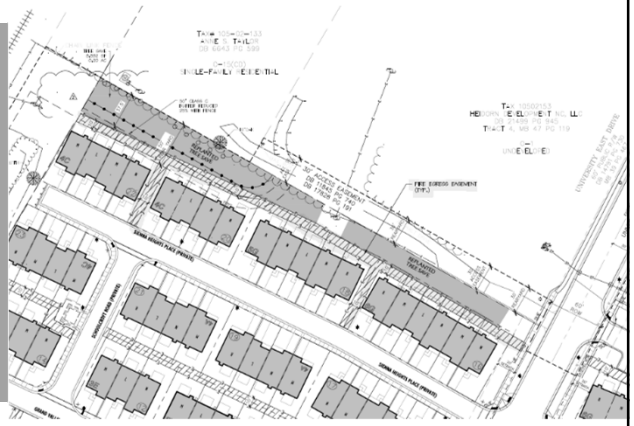
Townhome lots with no access to the public way through the backyard.



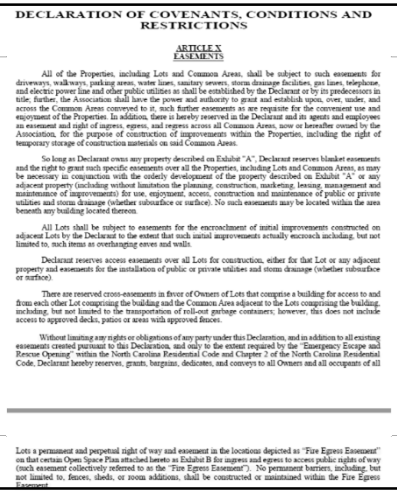
Public Way
R310

Egress may be guaranteed through an **Easement** or a **CCR** (Declaration of Covenants ,conditions and restrictions Agreement) in MCCE.

Egress easement



Declaration of Covenants, conditions and restrictions (CCR)



DECLARATION OF COVENANTS, CONDITIONS AND RESTRICTIONS

ARTICLE X
EASEMENTS

All of the Properties, including Lots and Common Areas, shall be subject to such easements for driveways, walkways, parking areas, water lines, sanitary sewers, storm drainage facilities, gas lines, telephone, and electric power line and other public utilities as shall be established by the Declarant or by its predecessors in title; further, the Association shall have the power and authority to grant and establish upon, over, under, and across the Common Areas conveyed to it, such further easements as are requisite for the convenient use and enjoyment of the Properties. In addition, there is hereby reserved in the Declarant and its agents and employees an easement and right of ingress, egress, and regress across all Common Areas, now or hereafter owned by the Association, for the purpose of construction of improvements within the Properties, including the right of temporary storage of construction materials on said Common Areas.

So long as Declarant owns any property described on Exhibit "A", Declarant reserves blanket easements and the right to grant such specific easements over all the Properties, including Lots and Common Areas, as may be necessary in conjunction with the orderly development of the property described on Exhibit "A" or any adjacent property (including without limitation the planning, construction, marketing, leasing, management and maintenance of improvements) for use, enjoyment, access, construction and maintenance of public or private utilities and storm drainage (whether subsurface or surface). No such easements may be located within the area beneath any building located thereon.

All Lots shall be subject to easements for the encroachment of initial improvements constructed on adjacent Lots by the Declarant to the extent that such initial improvements actually encroach including, but not limited to, such items as overhanging eaves and walls.

Declarant reserves access easements over all Lots for construction, either for that Lot or any adjacent property and easements for the installation of public or private utilities and storm drainage (whether subsurface or surface).

There are reserved cross-easements in favor of Owners of Lots that comprise a building for access to and from each other Lot comprising the building and the Common Area adjacent to the Lots comprising the building, including, but not limited to the transportation of roll-out garbage containers; however, this does not include access to approved decks, patios or areas with approved fences.

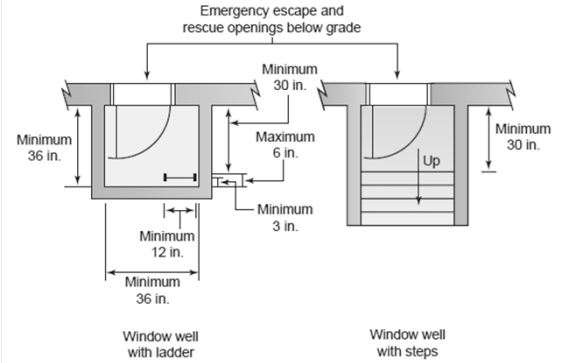
Without limiting any rights or obligations of any party under this Declaration, and in addition to all existing easements created pursuant to this Declaration, and only to the extent required by the "Emergency Escape and Rescue Opening" within the North Carolina Residential Code and Chapter 2 of the North Carolina Residential Code, Declarant hereby reserves, grants, bargains, dedicates, and conveys to all Owners and all occupants of all

Lots a permanent and perpetual right of way and easement in the locations depicted as "Fire Egress Easement" on that certain Open Space Plan attached hereto as Exhibit B for ingress and egress to access public rights of way (such easement collectively referred to as the "Fire Egress Easement"). No permanent barriers, including, but not limited to, fences, sheds, or room additions, shall be constructed or maintained within the Fire Egress Easement.

Window wells
R310.2.3

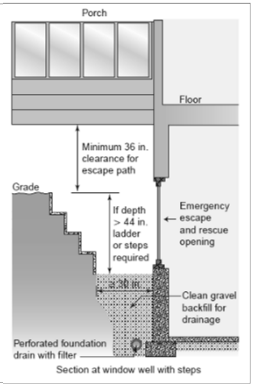
- Window wells must be at least **9 sf**. in area with a minimum dimension of **36".**
- The code requires a ladder or steps when the window well is greater than **44"** deep.

Window wells
R310.2.3



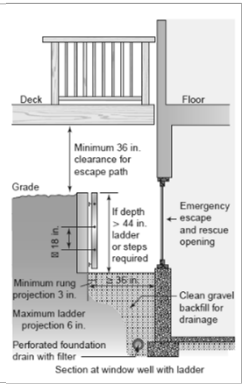
Window wells ladders
R310.2.3

- Window wells must be at least 9 sf with a minimum dimension of **36".**
- The code requires a ladder or steps when the window well is greater than **44"** deep.



Window wells ladders
R310.2.3

- A ladder or step is allowed to encroach into the required window well area no more than 6".
- A foundation drainage system is not required.



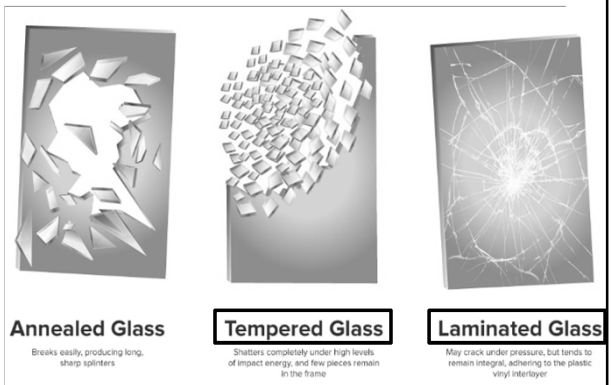
Safety Glazing

Glazing
R308

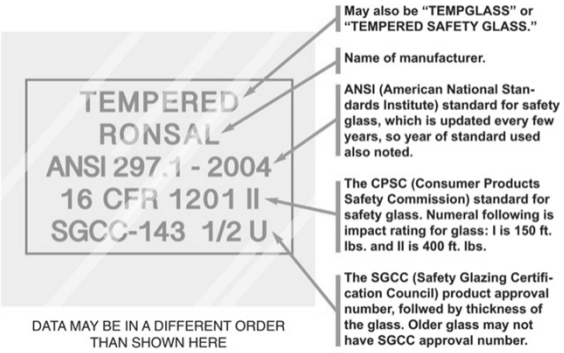
New!

- **R308** Reorganized
- **R308.4.4** Guards added
- **R308.4.5** 60" from water's edge. i.e. showers, hot tubs, saunas etc.
- **R308.4.6** Exterior doors with elevations < 8 ¼" do not require safety glass.

Types of safety glass
R308.4



Safety glass identification
R308.1



Identification alternatives
R308.1, exceptions

Other than tempered glass:
- Labels may be omitted where approved by the building official and an affidavit, certificate or other evidence is submitted indicating code compliance.

Tempered spandrel glass:
- A manufacturer can identify safety glazing with a removable paper designation, provided removal would destroy the designation. This ensures that the designation will not be applied to a noncomplying piece of glass.

Identification alternatives
R308.1, exceptions

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

Glazing Labeling in Hazardous Locations

Code: 2018 NC Residential Code **Date:** March 22, 2019
Section: R308.1

Question:
Is Section R308.1 referring to the glazing or the label being destroyed when removed?

Answer:
It is referring to the label itself and not the glazing. According to the 2015 IRC commentary, "A manufacturer can identify safety glazing with a removable paper designation, provided removal would destroy the designation. This ensures that the designation will not be applied to a noncomplying piece of glass".

Multi-pane assemblies
R308.1.1

- Allows labeling of only one pane of glass when the exposed area of each pane is ≤1 sf.
- All other panes must be labeled either "16 CFR 1201" or "ANSI Z97.1

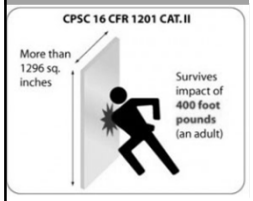
Impact load test required
R308.3

The code requires that glazing in **hazardous locations subject to human impact,** pass impact tests.

Exceptions:
1. Louvered windows and jalousies meeting the thickness and length limitations in Section R308.2.
2. Mirrors or glass hung on a wall or fitted with a backing.
3. Glass block constructed in accordance with Section R610.



Testing requirements
R308.3.1

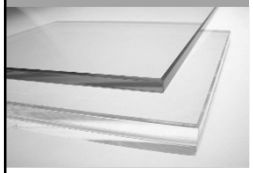


CPSC 16 - CFR 1201

- **Category II** required (unless otherwise indicated in Table 308.3.1). This is also a federal standard.

Exception:
Glazing NOT in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers may use **ANSI Z97.1.** and be **Class A** (unless indicated in table 308.3.1).

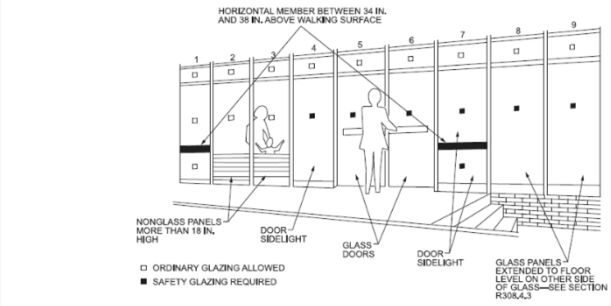
Safety glass
R308.4



The code identifies 7 locations that are hazardous to install safety glass.

1. In doors (fixed &operable)
2. Near doors
3. In windows
4. Guards and railings
5. Wet surfaces
6. Near stairs or ramps
7. Bottom of stair landings

Hazardous locations
R308.4.1



For SI: 1 inch = 25.4 mm.

Figure R308.4(1)
HAZARDOUS LOCATIONS

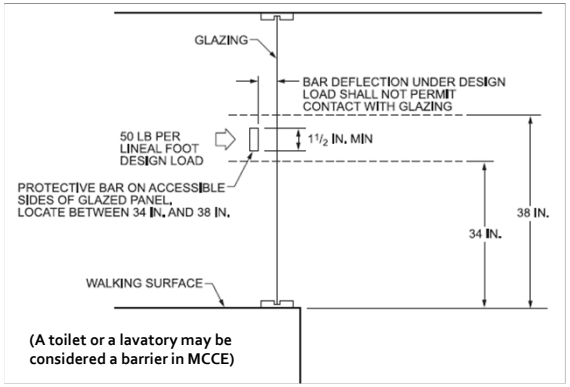
1. Doors
R308.4.1

Safety glazing is required in fixed and operable panels of swinging, sliding and bi-fold doors.

Exceptions:
- Glazed openings where a 3-in.-diameter sphere cannot pass through.
- Decorative glazing.

Barrier exception for windows

R308.4.3 , exception 2

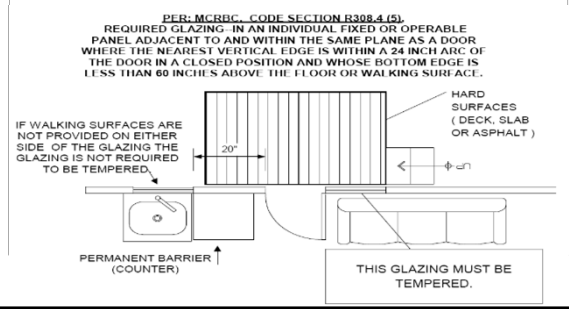


(A toilet or a lavatory may be considered a barrier in MCCE)

What is considered a walking surface?

R308.4.1

Any walking surface interior or exterior. The existence of a permanent barrier on one side of the window would not eliminate the need for tempered glass if the conditions on other side would still require tempered glass.



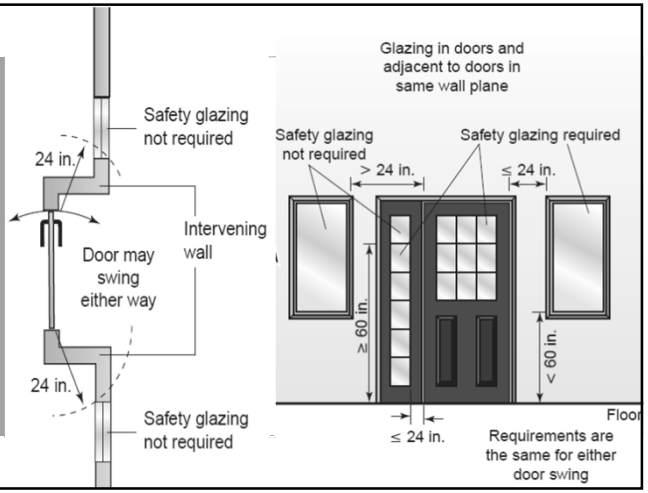
Barrier exception

R308.4.2 , exception 2

A lavatory counter can be considered a barrier in MCCE.

2.Near doors

R308.4.2



2.Near doors
R308.4.2

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

Tempered Glass Next to Doors

Code: 2018 Residential Code **Date:** March 22, 2019
Section: R308.4.2

Question:
If a window is located within 24" of a door, is tempered glass required?

Answer:
Yes, if the glazing is in the same plane as the door and the bottom edge of the glazing is less than 60 inches above the floor.

No, if the glazing is not in the same plane as the door or the bottom edge of the glazing is 60 inches or more above the floor.

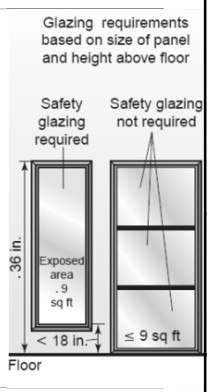
Exceptions near doors
R308.4.2

- Decorative glazing.
- Intervening wall or other permanent barrier between door and glazing.
- Access through door is to closet or storage area ≤ 3 ft. in depth.
- Glazing that is adjacent to the fixed panel of patio doors.

3. Windows
R308.4.3

All four stated conditions must occur before safety glazing is required:

1. The area of an individual pane must be more than 9 sf.
2. The bottom edge must be less than 18" above the floor.
3. The top edge must be more than 36" above the floor.
4. One or more walking surfaces must be within 36" measured horizontally from the glazed panel.



3. Windows
R308.4.3

NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000

Tempered Glass for Windows 9 Square Feet or More

Code: 2018 Residential Code **Date:** March 22, 2019
Section: R308.4.3

Question:
If a window is 9 square feet or more, does it have to be tempered?

Answer:
Section R308.4.3 Glazing in windows. Glazing in an individual fixed or operable panel that meets **all** of the following conditions shall be considered to be a hazardous location:

1. The exposed area of a single pane is larger than 9 square feet,
2. The bottom edge of the glass is less than 18 inches above the floor,
3. The top edge of the glazing is more than 36 inches above the floor; and
4. One or more walking surfaces are within 36 inches, measured horizontally and in a straight line, of the glazing.

Exceptions:

1. Decorative glazing.
2. Where a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass and have a cross-sectional height of not less than 1-1/2 inches.
3. Outboard panes in insulating glass units and other multiple glazed panels where the bottom edge of the glass is 25 feet or more above grade, a roof, walking surfaces or other horizontal [within 45 degrees of horizontal] surface adjacent to the glass exterior.

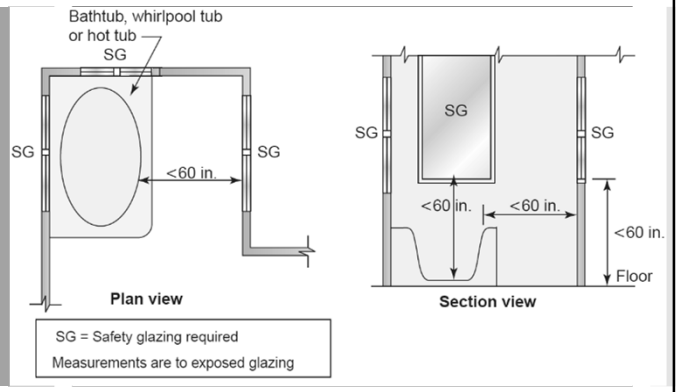
If any one of the 4 items in R308.4.3 are not met, then the window is not required to be tempered.

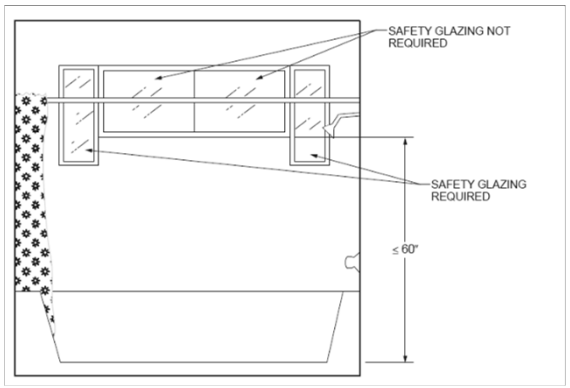
If either of the 3 exceptions in R308.4.3 are met then the glazing is not required to meet the safety glazing requirements of R308.4.3.

4. In guards and railings
R308.4.4

Glazing in *guards* and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered to be a hazardous location.

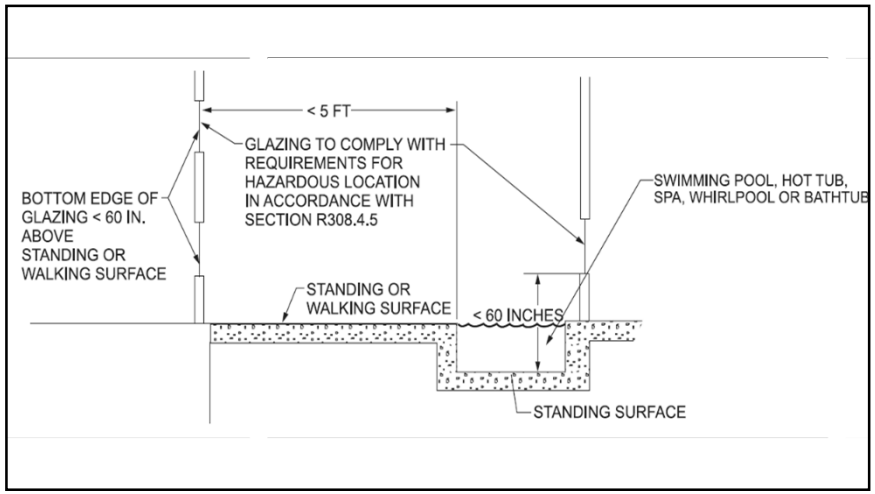
5. Wet surfaces
R308.4.5

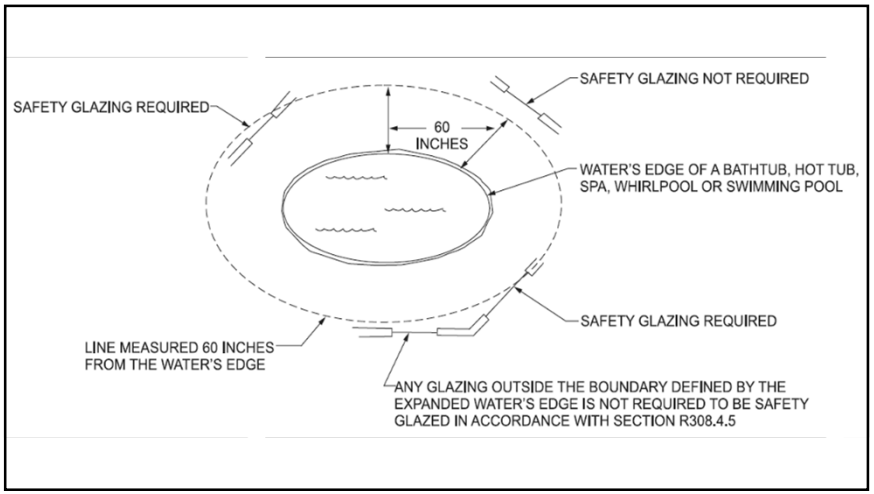




5. Wet surfaces
R308.4.5

Glazing in walls or fences near swimming pools
- ≤ 60 in. of water's edge
- < 60 in. above walking surface

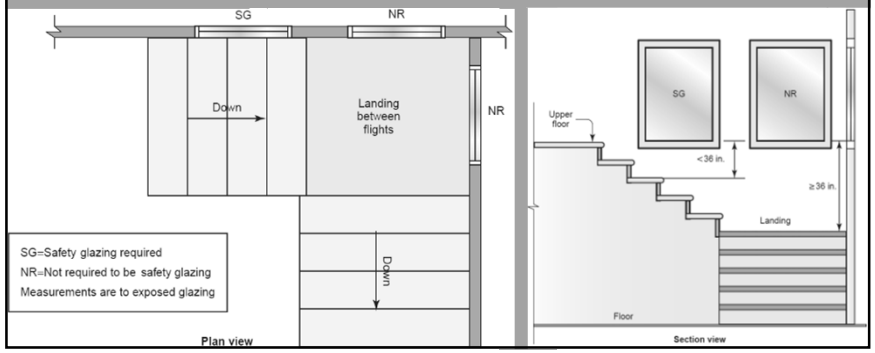




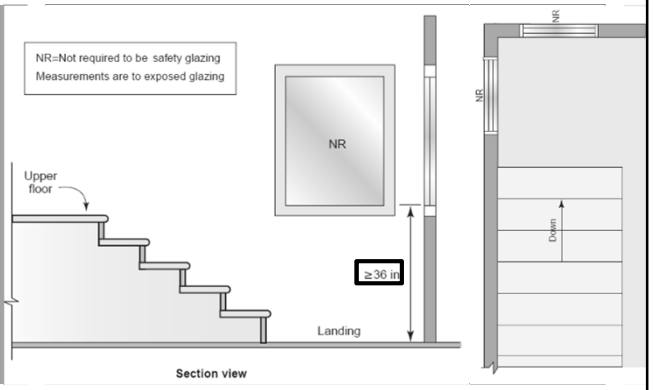
6. Near stairs or ramps

R308.4.6

Exceptions:
1. A rail is installed.
2. Glass is >36" a.f.f.
3. The exterior door elevation is ≤8 ¼"



7. At the bottom of stair landings R308.4.7



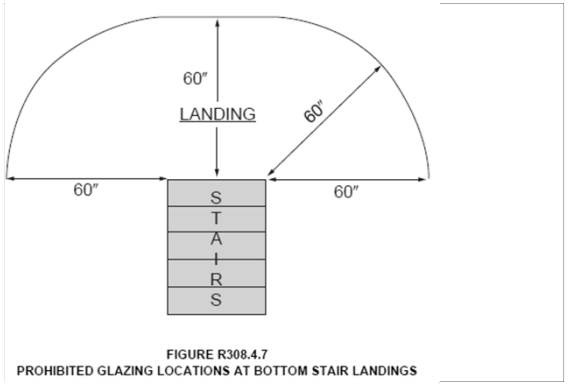
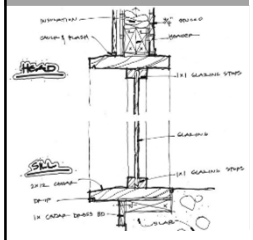


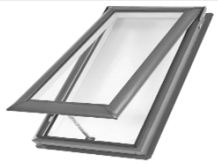
FIGURE R308.4.7
PROHIBITED GLAZING LOCATIONS AT BOTTOM STAIR LANDINGS

Site-built windows
R308.5



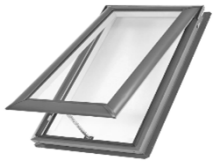
- Because site-built windows are not constructed in a manufacturing facility that follows industry standards, they must be constructed in accordance with Section2404 of the IBC.
- Section2404 sets the required wind, snow, seismic and dead loads on glass.

Skylight & slopped glazing
R308.6



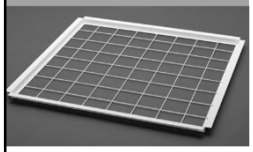
- Glazing installed in roofs or walls that are on a slope **15 degrees or more** from the vertical.
- The is to protect occupants from the possibility of falling glazing materials.

Skylights & slopped glazing materials
R308.6.2



- **Laminated glass**
  - 0.015" polyvinyl butyral interlayer
  - ≤16 sf. area
  - Highest point is at 12 ft. af.f. max.
- **Fully tempered glass** (with screen protection).
- **Heat-strengthened glass** (with screen protection below).
- **Wired glass.**
- **Approved rigid plastics.**

Safety Screens
R308.6.7



- Screens must support the weight of the glass.
- The screen and its fastenings must be capable of supporting twice the weight of the glazing.

Greenhouses
R308.6.6

- The glazing regulations for greenhouses are less stringent because greenhouses are seldom occupied during storms that might break the glass.
- Screens are not required for sloped areas of greenhouses if the ridge of the greenhouse is not more than 20 feet above grade.

Questions?

Q: How do we know which interpretations by DOI are formal and which ones are informal?

A: All interpretations posted on DOI are considered formal and shall be accepted by MCCE or any other jurisdiction. If an interpretation is deemed informal by DOI, it will be noted as such.

Next Meeting:

Code Connection - HBA July 3th

Please e-mail topics to:
eurilynn.caraballoluccioni@mecknc.gov

Thank you

November 2019

INTERIOR & EXTERIOR FINISHES

APPLICATION
R701.1

Chapter 7: Wall Coverings

Provides the minimum requirements applicable to wall covering materials used both in exterior and interior applications

Purpose of Building finishes:

1. Protect structural elements from impact or moisture damage.

2. Improve insulating quality, sound transmission control and fire resistance.

INTERIOR FINISHES

Per NCRC 2018 - Chapter 7

INSTALLATION
R701.2, R702.3.5

Interior finishes shall be installed when the building is weather tight, to prevent moisture and mold problems.

R701.2 Installation. Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

INTERIOR FINISHES REGULATED BY CODE:

- ▶Drywall
- ▶Plaster
- ▶Ceramic tile
- ▶Wood

Each Material has specific installation requirements for:

- Material Orientation
- Backing Support
- Spacing
- Size
- Method of attachment.

INTERIOR FINISHES NOT REGULATED BY CODE:

- ▶Flooring
- ▶Paint
- ▶Wallpaper

GYPSUM:

- Gypsum wallboard is a rigid, light-weight building product, valued for its fire-resistant properties. It has been used in many applications for centuries. It was used as plaster in the Egyptian pyramids.
- When gypsum is tapped and finished is commonly referred to as drywall.
- It is also commonly used as fertilizer, soil conditioner and as a filler ingredient in many foods. National Gypsum states that the average person eats about 28 pounds of gypsum in a lifetime.

National Gypsum

- NG is one of the world's largest manufacturers, with headquarters located in Charlotte.
- The Mt. Holly plant can produce 1-billion SF at 500' per min. That is enough wallboard to complete 100,000 average-sized homes per year.
- It also uses solid waste byproduct gypsum from nearby power plants to produce wallboard.

REGULAR VS. TYPE X

- Both **Regular** and **Type X** gypsum board are covered under the ASTM C 1396, gypsum board standard specification.
- Regular drywall has **naturally occurring fire resistance** due to the presence of gypsum in the core but is not fire rated.
- Type X drywall has special core additives that allow it to be used in fire rated designs and usually comes in 5/8" thickness.
- Type X drywall products will have a UL/ULC Marking printed on the back of each board identifying it as a fire-resistance rated board.

INTERIOR GYPSUM BOARD

R702.3, Table R702.3.5

- When using ⅜-inch material, the code requires installation perpendicular to ceiling framing.
- When using with a water-based texture finish, see footnote D.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS

THICKNESS OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING
				Nails[a]	Screws[b]	
Application without adhesive						
3/8	Ceiling[d]	Perpendicular	16	7	12	13 gage, 1 1/4" long, 19/64" head; 0.098" diameter, 1 1/4" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 1 1/4" long, 7/32" head.
	Wall	Either direction	16	8	16	
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 5/8" long, 19/64" head; 0.098" diameter, 1 1/4" long, annular-ringed; 5d cooler nail, 0.086" diameter, 1 1/2" long, 15/64" head; or gypsum board nail, 0.086" diameter, 1 3/8" long, 9/32" head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 5/8" long, annular-ringed; 6d cooler nail, 0.092" diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915" diameter, 1 7/8" long, 19/64" head.
	Ceiling	Perpendicular	24	7	12	
	Type X at garage ceiling beneath habitable rooms	Perpendicular	24	6	6	1 7/8" long 6d coated nails or equivalent drywall screws. Screws shall comply with Section R702.3.5.1
	Wall	Either direction	24	8	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 7/8" long, annular ringed; 6d cooler nail, 0.092" diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915" diameter, 1 7/8" long, 19/64" head.
	Wall	Either direction	16	8	16	
Application with adhesive						
3/8	Ceiling[d]	Perpendicular	16	16	16	Same as above for 3/8" gypsum board and gypsum panel products.
	Wall	Either direction	16	16	24	
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board and gypsum panel products, respectively.
	Ceiling[d]	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
Two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board and gypsum panel products; face ply installed with adhesive.
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 2½ inches apart shall be permitted to be used with the pair of nails spaced 12 inches on center.

b. Screws shall be in accordance with Section R702.3.5.1. Screws for attaching gypsum board or gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than 7/16 inch.

c. Deleted.

d. Three-eighths-inch-thick single-ply gypsum board or gypsum panel product shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board or gypsum panel product shall be applied perpendicular to framing. Where applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to 1/2 inch for 16-inch on center framing, and from 1/2 inch to 5/8 inch for 24-inch on center framing or 1/2-inch sag-resistant gypsum ceiling board shall be used.

GYPSUM SCREWS
R702.3.5,

- Screws S or W screws shall penetrate 5/8” min. into wood. and 7/16” into SIPS.

Type S
fine-thread screw for fastening gypsum board to cold formed steel members.

Type W
Coarse-thread screw for fastening gypsum board to wood members.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS

THICKNESS OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING
				Nails[a]	Screws[b]	
Application without adhesive						
3/8	Ceiling[d]	Perpendicular	16	7	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 1/4" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 1 7/8" long, 1/4" head.
	Wall	Either direction	16	8	16	
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 1/4" long, annular-ringed; 5d cooler nail, 0.086" diameter, 1 7/8" long, 17/64" head; or gypsum board nail, 0.086" diameter, 1 7/8" long, 9/32" head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 7/8" long, annular-ringed; 6d cooler nail, 0.092" diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915" diameter, 1 7/8" long, 19/64" head.
	Ceiling	Perpendicular	24	7	12	
	Type X at garage ceiling beneath habitable rooms	Perpendicular	24	6	6	1 7/8" long 6d coated nails or equivalent drywall screws. Screws shall comply with Section R702.3.5.1
	Wall	Either direction	24	8	12	13 gage, 1 7/8" long, 19/64" head; 0.098" diameter, 1 7/8" long, annular-ringed; 6d cooler nail, 0.092" diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915" diameter, 1 7/8" long, 19/64" head.
	Wall	Either direction	16	8	16	
Application with adhesive						
3/8	Ceiling[d]	Perpendicular	16	16	16	Same as above for 3/8" gypsum board and gypsum panel products.
	Wall	Either direction	16	16	24	
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board and gypsum panel products, respectively.
	Ceiling[d]	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
Two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board and gypsum panel products; face ply installed with adhesive.
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 2 1/2 inches apart shall be permitted to be used with the pair of nails spaced 12 inches on center.

b. Screws shall be in accordance with Section R702.3.5.1. Screws for attaching gypsum board or gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than 7/16 inch.

c. Deleted.

d. Three-eighths-inch-thick single-ply gypsum board or gypsum panel product shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board or gypsum panel product shall be applied perpendicular to framing. Where applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to 1/2 inch for 16-inch on center framing, and from 1/2 inch to 5/8 inch for 24-inch on center framing or 1/2-inch sag resistant gypsum ceiling board shall be used.

INTERIOR GYPSUM BOARD
R702.3, Table R702.3.5

- Parallel vs. Perpendicular Orientation
- Typical single nailing application.
- Footnote A. Permits double nailing if adhesive is omitted.

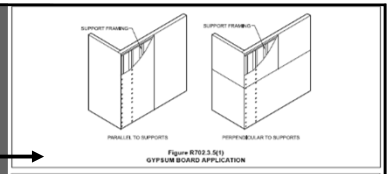


Figure R702.3.5(1)
GYPSUM BOARD APPLICATION

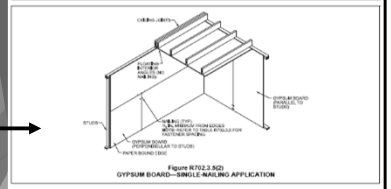


Figure R702.3.5(2)
GYPSUM BOARD—SINGLE-NAILING APPLICATION

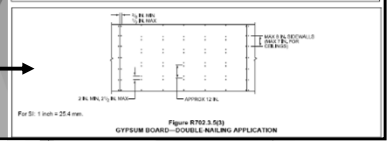
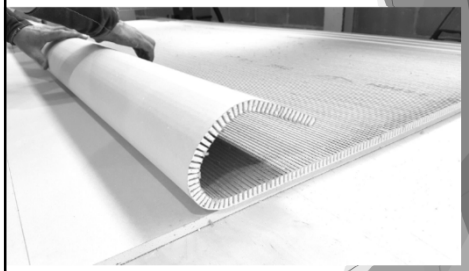


Figure R702.3.5(3)
GYPSUM BOARD—DOUBLE-NAILING APPLICATION

TYPE C / SPECIAL TYPE X

- Better than Type X.
- Enhanced with glass fibers and other ingredients for premium fire protection. Type C can remain intact for prolonged periods of time during a fire.
- Suitable for interior applications only. It should not be used in areas with extreme humidity.

FLEXIBLE TYPE



Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of the same thickness.

CEILING TYPE

Manufactured to have more sag and crack resistance than regular-type gypsum board.

CEILING TYPE

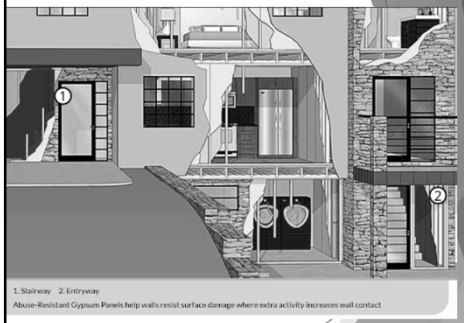
Generally a gypsum board ceiling does not serve as a load-carrying structural element for other than its own weight.

If it does, for bracing etc. **See section R702.3.6**

FOIL-BACKED TYPE

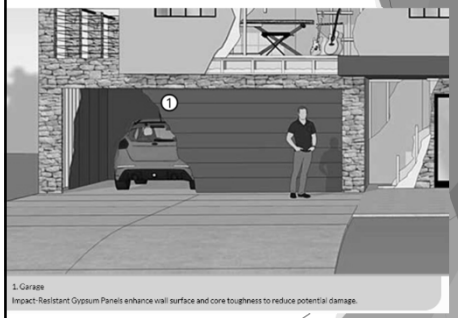
Provides an optimal vapor retarder that prevents condensation from occurring in the wall cavity.

ABUSE RESISTANT



Manufactured with fiberglass mat instead of paper to produce greater resistance to damage such as scuffs, scratches, dents, and abrasion.

HIGH-IMPACT



- Same as Abuse-Resistant, except that it has embedded a layer of impact resistant mesh for greater resistance to through penetration (impact resistance).

MOISTURE & MOLD RESISTANT

- Typically 5/8 inch thick, but not necessarily Type X.
- Verify if it is also allowed as Type X.
- Can be used at interior face of exterior walls or wherever moisture resistant Gypsum wallboard is desired.
- Made with mold resistant paper, not waterproof.

MOISTURE & MOLD RESISTANT

- It is not intended for areas constantly humid, such as:
  - Saunas
  - Steam Rooms
  - Gang Showers
  - Indoor pools

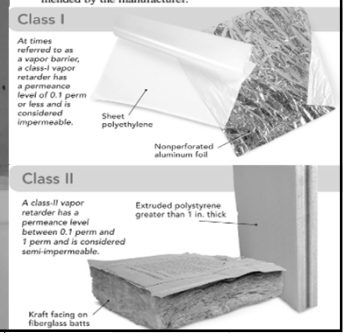
MOISTURE & MOLD RESISTANT

- Moisture and mold resistant gypsum (i.g. greenboard) is not intended for areas in contact with water OR constantly humid, such as:
  - Saunas
  - Steam Rooms
  - Showers or Gang showers
  - Indoor pools

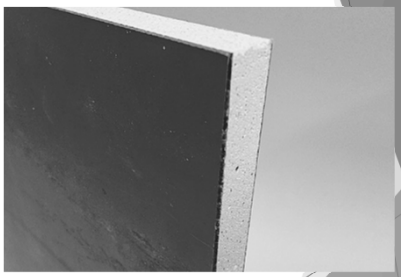
WATER RESISTANT GYPSUM

- DO NOT install water resistant gypsum over Class 1 or 2 vapor retarders.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C1396, C1178 or C1278. Use of water-resistant gypsum backing board shall be permitted on ceilings. Use of water-resistant gypsum backing board shall be permitted on ceilings where framing spacing does not exceed 12 inches (305 mm) on center for $^{1}/_{2}$-inch (12.7 mm) thick or 16 inches (406 mm) for $^{5}/_{8}$-inch (16 mm) thick gypsum board. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.



LEAD-LINED



Has lots of specifications:

- Thickness specified by a radiation report.
- May require lead-lined plywood.
- Lead joints strips
- Fastener covers
- Vertical joints
- Used typically for X-rays

TILE BACKER BOARD

R702.3.7, R702.4.2

Specifies the materials allowed to be used as backers for wall tile and wall panels in tub and shower areas.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C1396, C1178 or C1278. Use of water-resistant gypsum backing board shall be permitted on ceilings. Use of water-resistant gypsum backing board shall be permitted on ceilings where framing spacing does not exceed 12 inches (305 mm) on center for $^{1}/_{2}$-inch (12.7 mm) thick or 16 inches (406 mm) for $^{5}/_{8}$-inch (16 mm) thick gypsum board. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

TABLE R702.4.2
BACKER BOARD MATERIALS

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Fiber-reinforced gypsum panels	ASTM C1278
Nonasbestos fiber-cement backer board	ASTM C1288 or ISO 8336, Category C
Nonasbestos fiber mat reinforced cementitious backer units	ASTM C1325

TILE BACKER BOARDS

- **Water-Resistant Gypsum (R702.3.7)**
  - Silicone treated core
  - Fiberglass matting
  - Vapor retardant coating
- **Cementitious**
  - Thin sheets of concrete with a fiberglass mesh.

TABLE R702.4.2
BACKER BOARD MATERIALS

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Fiber-reinforced gypsum panels	ASTM C1278
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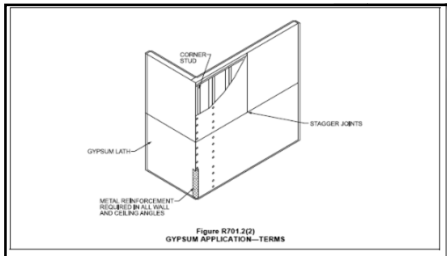


Figure R701.2(2)
GYPSUM APPLICATION—TERMS

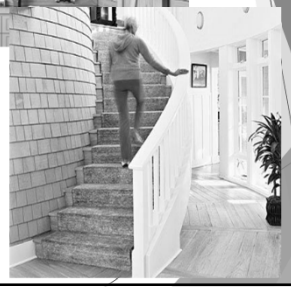
TABLE R702.1(1)
THICKNESS OF PLASTER

PLASTER BASE	FINISHED THICKNESS OF PLASTER FROM FACE OF LATH, MASONRY, CONCRETE (inches)	
	Gypsum Plaster	Cement Plaster
Expanded metal lath	$\frac{1}{2}$, minimum[a]	$\frac{3}{4}$, minimum[a]
Wire lath	$\frac{1}{2}$, minimum[a]	$\frac{3}{4}$, minimum (interior)[a] $\frac{7}{8}$, minimum (exterior)[a]
Gypsum lath[d]	$\frac{1}{2}$, minimum	$\frac{3}{4}$, minimum (interior)[a] $\frac{7}{8}$, minimum (exterior)[a]
Masonry walls[e]	$\frac{1}{2}$, minimum	$\frac{3}{4}$, minimum
Monolithic concrete walls[c, e]	$\frac{1}{2}$, maximum	$\frac{3}{4}$, maximum
Monolithic concrete ceilings[c, e]	$\frac{3}{8}$, maximum[d]	$\frac{3}{4}$, maximum
Gypsum veneer base[f, g]	$\frac{1}{2}$, minimum	$\frac{3}{4}$, minimum (interior)[a] $\frac{7}{8}$, minimum (exterior)[a]
Gypsum sheathing[g]	—	$\frac{3}{4}$, minimum (interior)[a] $\frac{7}{8}$, minimum (exterior)[a]

For SI: 1 inch = 25.4 mm.
a. Where measured from back plane of expanded metal lath, exclusive of ribs, or self-furring lath, plaster thickness shall be $\frac{1}{16}$ inch minimum.
b. Where measured from face of support or backing.
c. Because masonry and concrete surfaces vary in plane, thickness of plaster need not be uniform.
d. Where applied over a liquid bonding agent, finish coat shall be permitted to be applied directly to concrete surface.
e. Approved acoustical plaster shall be permitted to be applied directly to concrete or over base coat plaster, beyond the maximum plaster thickness shown.
f. Attachment shall be in accordance with Table R702.3.5.
g. Where gypsum board is used as a base for cement plaster, a water-resistive barrier complying with Section R703.2 shall be provided.

INTERIOR PLASTER
R702.2

- Multicoat plastering has been commonplace for the last century.
- Tables R702.1(2) , R702.1(3), regulate various types of multicoat plaster application.
- Location, Materials, Substrates, Number of coats, cure time, Thickness, Joints, fasteners, etc.



WOOD WALL FINISHES

- **Paneling and Wood shakes**
- **(R702.5, R702.6)**
  - These sections contains requirements for wood veneer and hardboard paneling.
  - Because there is no concern for weather protection, the shakes or shingles may be attached directly to the studs or furring strips with nails, staples or glue.

INTERIOR MASONRY VENEER
R702.1

- Interior wall coverings of masonry veneer must be supported in accordance with Section R703.8.1 and anchored in accordance with Section R703.8.4.
- No airspace is required for interior masonry veneer since it is not required to be weather resistant.

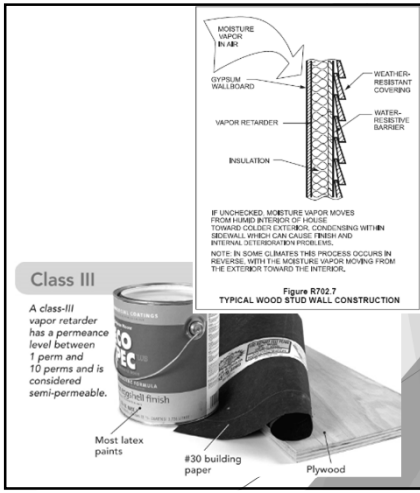


Figure R702.7
TYPICAL WOOD STUD WALL CONSTRUCTION

VAPOR RETARDERS

- **R702.7**
- The purpose of this section is to provide prescriptive methods for moisture control.
- Wall assemblies can be designed and constructed to dry inward, outward and to both sides.
- In our zone a Class III vapor retarder is required.
- Class III vapor retarders allow more moisture vapor to pass through them.

SDI
R302.9.2

Fabrics, Kraft or Foil Based batts do not meet code as an interior finish.

Examples of SDI:
Cement Board = 0
Polystyrene Crown Molding = 85
Western red cedar w/ poly = 218

R302.9.2 Smoke-developed index. Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

EXTERIOR FINISHES

Per NCRC 2018 - Chapter 7

DENS GLASS®

The Dens™ Brand of High-Performance Gypsum Products from Georgia-Pacific	
DensGlass® Sheathing	The original and universal standard of exterior gypsum sheathing offers superior weather resistance, with a 12-month weather exposure limited warranty. Look for the familiar GOLD color.
DensShield® Tile Backer	Acrylic-coated tile backer stops moisture at the surface. Lightweight and strong, built for speed on the job site. IBC/IRC Code Compliant. GREENGUARD listed for microbial resistance.
DensDeck® Roof Boards	Fiberglass mat roof board used as the ideal thermal barrier and cover board to improve resistance to wind uplift, hail, foot traffic, fire, moisture and mold in a broad range of commercial roofing applications. Look for green DensDeck Prime and DensDeck DuraGuard, too.
DensGlass® Shaftliner	Specially-designed panels for moisture-prone vertical or horizontal shafts, interior stairwells and area separation wall assemblies. 12-month weather exposure limited warranty. GREENGUARD listed for microbial resistance.
DensArmor Plus® High-Performance Interior Panel	High-performance interior panel accelerates scheduling because it can be installed before the building is dried-in. 12-month weather exposure limited warranty. GREENGUARD Indoor Air Quality Certified® GREENGUARD Children & Schools™ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.
DensArmor Plus® Abuse-Resistant Interior Panel	Same benefits as DensArmor Plus® High-Performance Interior Panel with added resistance to scuffs, abrasions and surface indentations. Ideal for healthcare facilities and schools. GREENGUARD Indoor Air Quality Certified® GREENGUARD Children & Schools™ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.
DensArmor Plus® Impact-Resistant Interior Panel	Even greater durability with an embedded impact-resistant mesh for the ultimate resistance in high traffic areas. Ideal for healthcare facilities, schools and correctional institutions. GREENGUARD Indoor Air Quality Certified® GREENGUARD Children & Schools™ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.

Used on fast schedules. The product comes with a 12 month in-place exposure warranty which means that it can be hung before installing doors and windows.

Resistant to “normal” weather conditions. Do not allow water to pond or settle on sheathing.

EXTERIOR GYPSUM

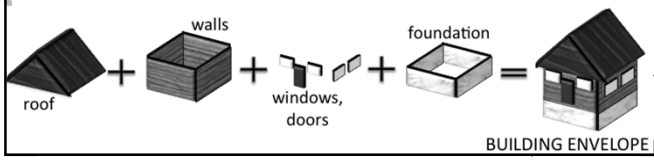
- Used for ceilings and soffits.
- Fiberglass faced.

- Not a nail base.
- Not a tile backer.
- Not structural sheathing.
- Not installed below grade.

THE EXTERIOR ENVELOPE
R703

The exterior wall envelope of a dwelling is protected by:

- Roof
- Siding or veneers
- Water-resistant barriers
- Flashing
- Windows & Doors
- Foundation waterproofing



WIND RESISTANCE R703.1.2, R703.3.1

- All components in an exterior wall assembly must be able to resist wind loads of 30 psf. and/or per tables R301.2(2) and R301.2(3).
- The wind resistance of the exterior wall assembly can be determined by testing or design analysis.

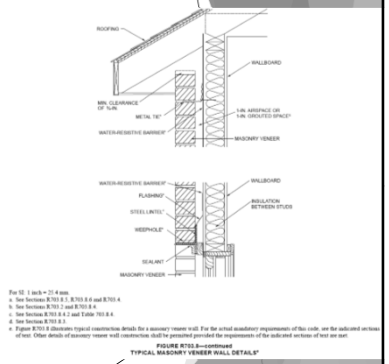
WATER RESISTIVE BARRIERS
R703.1, R703.2

Required over all the exterior wall sheathing including unheated areas.

- No. 15 asphalt felt with 2" horizontal laps and 6-inch vertical laps.
- House wrap per manufacturer's specifications
- Other approved materials by the CEO.

WATER RESISTIVE BARRIERS
R703.1.1, R703.2

- Water Resistive barriers are not intended to protect against bulk water intrusion. That must be done through drainage.
- There are no specific prescriptive code requirements for providing drainage. It just needs to drain. Examples:
  - For Brick: a rain-screen system
  - For vinyl: Paper, flashing & weeps.
  - For stucco: 2 layers of Garde D paper



BARRIERS UNDER STUCCO AND ADHERED MASONRY R703.1, R703.2

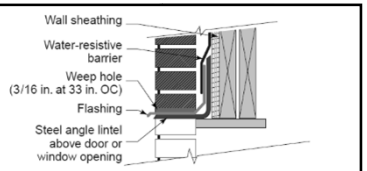
- Two layers of Grade D paper Type 1 felt.
- **Other e**quivalent products approved by the CEO.

FLASHING

R703.4

The code requires corrosion-resistant flashing at:

- Exterior window and door openings
- Penetrations
- Projections
- Wall and roof intersections
- Intersections of dissimilar materials.



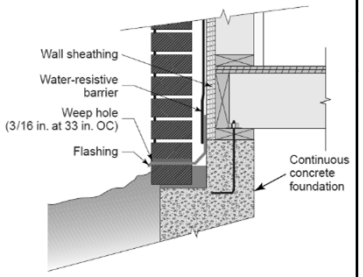


FIGURE 7-2 Brick veneer details

In our seismic zone (B), the code permits veneers:

- Up to 3 stories and 30 feet above noncombustible foundations. Plus, an additional 8 feet for gable end walls.
- A maximum thickness of 5 inches
- A maximum weight of 50 psf. and not more than 40 psf. when designed to limit deflection to 1/600 of the span of the supporting members.

MASONRY & STONE VENEER

R703.8, Table R703.8(1), Table R703.8(2)

TABLE R703.8(1)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

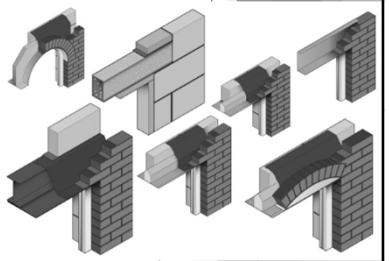
SEISMIC DESIGN CATEGORY	NUMBER OF WOOD-FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION[a] (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]	WOOD-FRAMED STORY
A or B	Wood: 1, 2 or 3	30	5	50	all
C	1	30	5	50	1 only
	2	30	5	50	top
					bottom
	Wood only: 3	30	5	50	top
					middle
					bottom

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa.
a. An additional 8 feet is permitted for gable end walls. See also story height limitations of Section R301.3.
b. Maximum weight is installed weight and includes weight of mortar, grout, lath and other materials used for installation. Where veneer is placed on both faces of a wall, the combined weight shall not exceed that specified in this table.

LINTELS

R703.8.2, R703.8.3

- Steel or noncombustible lintels are required above openings and must have bearing support of at least 4 inches at each end.
- Steel lintels require a rust-inhibitive shop coat on all surfaces or otherwise be protected against corrosion.



LINTEL SIZING
R703.8.2, R703.8.3

Based on Tables R703.8.3.1 & R703.8.3.2, we can determine the minimum size of a steel lintel supporting masonry veneer .

TABLE R703.8.3.1
ALLOWABLE SPANS FOR LINTELS SUPPORTING MASONRY VENEER[a, b, c, d, e]

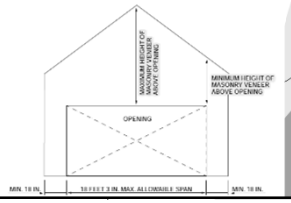
SIZE OF STEEL ANGLE[a, c, d] (inches)	NO STORY ABOVE	ONE STORY ABOVE	TWO STORIES ABOVE	NO. OF ½-INCH OR EQUIVALENT REINFORCING BARS IN REINFORCED LINTEL[b, d]
3 × 3 × 5/16	6'-0"	4'-6"	3'-0"	1
4 × 3 × 5/16	8'-0"	6'-0"	4'-6"	1
5 × 3½ × 5/16	10'-0"	8'-0"	6'-0"	2
6 × 3½ × 5/16	14'-0"	9'-6"	7'-0"	2
2-6 × 3½ × 5/16	20'-0"	12'-0"	9'-6"	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. Long leg of the angle shall be placed in a vertical position.
b. Depth of reinforced lintels shall be not less than 8 inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than 8 inches into the support.
c. Steel members indicated are adequate typical examples; other steel members meeting structural design requirements shall be permitted to be used.
d. Either steel angle or reinforced lintel shall span opening.
e. Spans over 4 feet (1219 mm) shall be shored up until cured.

TABLE R703.8.3.2
HEIGHT OF MASONRY VENEER ABOVE OPENING

MINIMUM HEIGHT OF MASONRY VENEER ABOVE OPENING (INCH)	MAXIMUM HEIGHT OF MASONRY VENEER ABOVE OPENING (FEET)
13	< 5
24	5 to < 12
60	12 to height above support allowed by Section R703.8

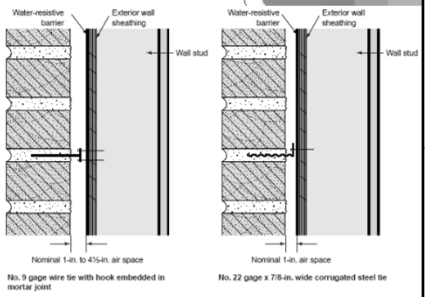
For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.



VENEER ANCHORING
R703.8.4, Table R703.8.

Veneer is anchored to the structure with corrosion-resistant metal ties:

- No. 9-gauge strand wire
- No. 22-gauge , ⅞-inch corrugated sheet metal.



Important facts:

VENEER - AIR SPACE
R703.8.4, Table R703.8.

- Veneer is not impervious to water penetration. An air space and a water resistive barrier are necessary.
- Mortar is not permitted to fill the air space. It cannot impede the flow of water.
- Air space can be filled with approved grout.
- Air space between sheathing and veneer:
  - nominal 1 in. for corrugated ties
  - nominal 1 in. to 4½ in. for wire ties

VENEER - AIR SPACE
R703.8.4, Table R703.8.

- Why is the air space 1-inch minimum and 4-½ inch maximum?

1. When mortar falls into the cavity, it forms "bridges" for moisture passage and/or block the weep holes. An airspace less than 1 inch wide is impossible to keep clean.

2. When the wall has a big air gap, the brick ties tend to buckle with wind pressure, exposing the veneer to a lateral load.

VENEER - TIES

R703.8.4, Table R703.8.

Veneer is anchored to the structure with corrosion-resistant metal ties of

- No. 9-gauge strand wire or
- No. 22-gauge, ⅞-inch corrugated sheet metal.

TABLE R703.8.4
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER	AIRSPACE[a]	
Wood stud backing with corrugated sheet metal	22 U.S. gage (0.0299 in.) × ⅞ in. wide	8d common nail [b] (2½ in. × 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in.) with hook embedded in mortar joint	8d common nail [b] (2½ in. × 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum 4½ in. between backing and veneer

For SI: 1 inch = 25.4 mm.

a. An airspace that provides drainage and contains mortar from construction shall be permitted.

b. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

SIDING REQUIREMENTS

R703.3, R703.10, R703.11, Table 703.3(1)

Horizontal Joints require a minimum 1-inch lap, shiplap or a "Z" flashing

Fasteners must penetrate into the wood framing 1¼ or 1½ inches, depending on the siding material and the manufacturer's recommendations. (Optional depth requirements are under Table R703.3.2 for lightweight materials)

All siding requires secure attachment with approved corrosion-resistant fasteners.

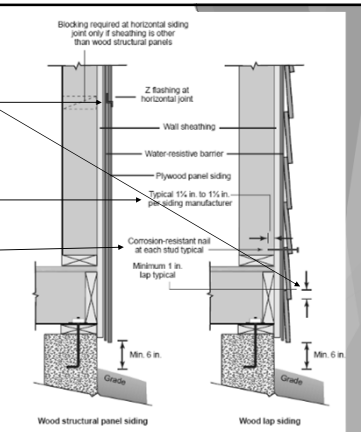


FIGURE 7-6 Siding details

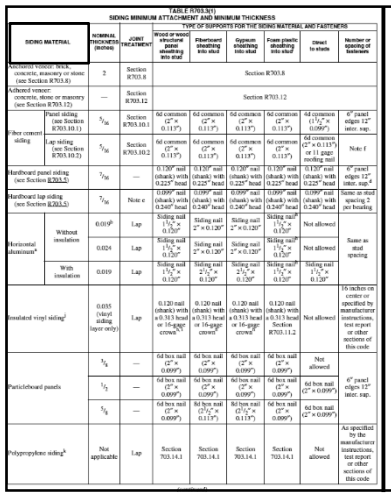


TABLE R703.3(1)
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS: Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Adhered veneer: concrete, stone or masonry (see Section R703.12)	—	Section R703.12	Section R703.12					
Fiber cement siding — Panel siding (see Section R703.10.1)	⅜	Section R703.10.1	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (1½" × 0.099")	6" panel edges 12" inter. sup.
Fiber cement siding — Lap siding (see Section R703.10.2)	⅜	Section R703.10.2	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" x 0.113") or 11 gage roofing nail	Note f
Hardboard panel siding (see Section R703.5)	7/16	—	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	6" panel edges 12" inter. sup.[g]
Hardboard lap siding (see Section R703.5)	7/16	Note e	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	Same as stud spacing 2 per bearing
Horizontal aluminum[b] — Without insulation	0.019[b]	Lap	Siding nail 1½" × 0.120"	Siding nail 2" × 0.120"	Siding nail 2" × 0.120"	Siding nail[f] 1½" × 0.120"	Not allowed	Same as stud spacing
Horizontal aluminum[b] — Without insulation	0.024	Lap	Siding nail 1½" × 0.120"	Siding nail 2" × 0.120"	Siding nail 2" × 0.120"	Siding nail[f] 1½" × 0.120"	Not allowed	
Horizontal aluminum[b] — With insulation	0.019	Lap	Siding nail 1½" × 0.120"	Siding nail 2½" × 0.120"	Siding nail 2½" × 0.120"	Siding nail[f] 1½" × 0.120"	Siding nail 1½" × 0.120"	
Insulated vinyl siding[j]	0.035 (vinyl siding layer only)	Lap	0.120 nail (shank) with a 0.313 head or 15-gage crown[h]	0.120 nail (shank) with a 0.313 head or 16-gage crown[h]	0.120 nail (shank) with a 0.313 head or 16-gage crown[h]	0.120 nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or as specified by manufacturer instructions, test report or other sections of this code
Particleboard panels	⅜	—	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	Not allowed	6" panel edges 12" inter. sup.
Particleboard panels	½	—	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" x 0.099")	
Particleboard panels	⅝	—	6d box nail (2" × 0.099")	8d box nail (2½" × 0.113")	8d box nail (2½" × 0.113")	8d box nail (2" × 0.099")	8d box nail (2" x 0.099")	
Polypropylene siding[k]	Not applicable	Lap	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Not allowed	As specified by the manufacturer instructions, test report or other sections of this code

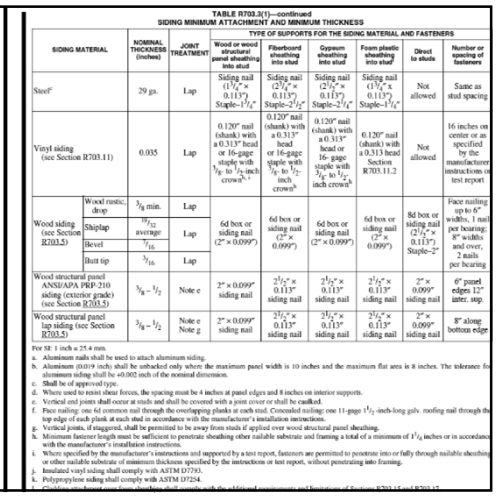


TABLE R703.3(1)—continued
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS: Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[f]	Direct to studs	Number or spacing of fasteners
Steel[c]	29 ga.	Lap	Siding nail (1½" × 0.113") Staple–1¾"	Siding nail (2¼" × 0.113") Staple–2½"	Siding nail (2¼" × 0.113") Staple–2¾"	Siding nail (1½" x 0.113") Staple–1¾"	Not allowed	Same as stud spacing
Vinyl siding (see Section R703.11)	0.035	Lap	0.120" nail (shank) with a 0.313" head or 16-gage staple with ⅞- to 1-inch crown[b]	0.120" nail (shank) with a 0.313" head or 16-gage staple with ⅞- to 1½-inch crown[b]	0.120" nail (shank) with a 0.313" head or 16- gage staple with ⅞- to 1½-inch crown[b]	0.120" nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or as specified by the manufacturers instructions or test report
Wood siding (see Section R703.5) — Wood rustic, drop	⅜ min.	Lap	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	8d box or siding nail (2½" × 0.113"), Staple–2"	Face nailing up to 6" widths, 1 nail per bearing; 8" widths and over, 2 nails per bearing
Wood siding (see Section R703.5) — Shiplap	19/32 average	Lap						
Wood siding (see Section R703.5) — Bevel	7/16							
Wood siding (see Section R703.5) — Butt tip	5/16	Lap						
Wood structural panel ANSI/APA PRP-210 siding (exterior grade) (see Section R703.5)	⅜ – ½	Note e	2" × 0.099" siding nail	2½" × 0.113" siding nail	2½" × 0.113" siding nail	2½" × 0.113" siding nail	2" × 0.099" siding nail	6" panel edges 12" inter. sup.
Wood structural panel lap siding (see Section R703.5)	⅜ – ½	Note e Note g	2" × 0.099" siding nail	2½" × 0.113" siding nail	2½" × 0.113" siding nail	2½" × 0.113" siding nail	2" × 0.099" siding nail	8" along bottom edge

For SI: 1 inch = 25.4 mm.

a. Aluminum nails shall be used to attach aluminum siding.

b. Aluminum (0.019 inch) shall be unbacked only where the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.

c. Shall be of approved type.

d. Where used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.

e. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.

f. Face nailing: one 6d common nail through the overlapping planks at each stud. Concealed nailing: one 11-gage 1½-inch-long galv. roofing nail through the top edge of each plank at each stud in accordance with the manufacturer's installation instructions.

g. Vertical joints, if staggered, shall be permitted to be away from studs if applied over wood structural panel sheathing.

h. Minimum fastener length must be sufficient to penetrate sheathing other nailable substrate and framing a total of a minimum of 1¼ inches or in accordance with the manufacturer's installation instructions.

i. Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report, without penetrating into framing.

j. Insulated vinyl siding shall comply with ASTM D7793.

k. Polypropylene siding shall comply with ASTM D7254.

l. Cedar shingle panel sizes (bundles) shall comply with the additional requirements and limitations of Sections R703.15 and R703.17.

VERTICAL SIDING

R703.3, R703.10, R703.11, Table 703.3(1)

- Vertical joints require batten covers or a combination of flashing and sealants.

HORIZONTAL SIDING

R703.3, R703.10, R703.11, Table 703.3(1)

Horizontal joints of panel siding require:

- a minimum 1-inch lap
- shiplap
- or a "Z" flashing over solid backing.

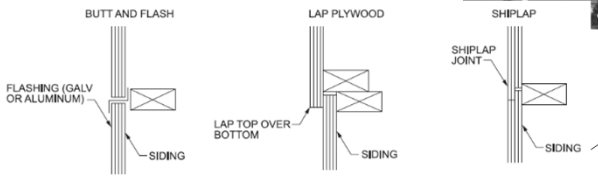


Figure R703.5.2(2)
HORIZONTAL JOINT TREATMENT OF PANEL SIDING

VINYL SIDING

R703.3, R703.10, R703.11, Table 703.3(1)

Must be installed in accordance with the manufacturer's installation instructions and meet requirements for:

- Design wind speed
- Wind exposure category

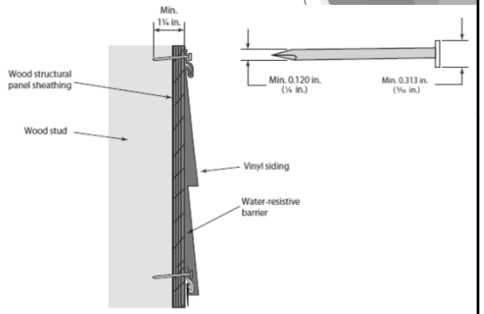


FIGURE 7-7 Vinyl siding attachment over wood structural panel sheathing

PANEL SIDING

R703.5.2

Structural wood panel siding is acceptable as an exterior wall covering if the plywood is approved for use in an exterior location and the joints are made waterproof by:

- Horizontal laps
- Battens
- Flashing
- Shiplaps.

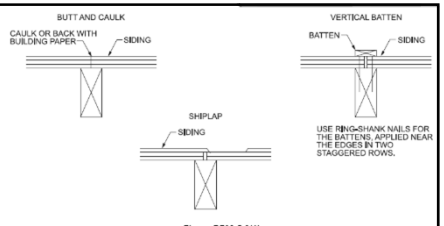


Figure R703.5.2(1)
VERTICAL JOINT TREATMENT OF PANEL SIDING

MASONRY VENEER

R703.8

- To be considered a veneer, the material cannot act structurally with the backing for structural strength.
- Table R703.8 gives some limitations because the weight of stone and brick can impose lateral loads upon the structure during a seismic event.

TABLE R703.8(1)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD- OR STEEL-FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION[a] (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]	WOOD- OR STEEL-FRAMED STORY
A or B	Steel: 1 or 2 Wood: 1, 2 or 3	30	5	50	all

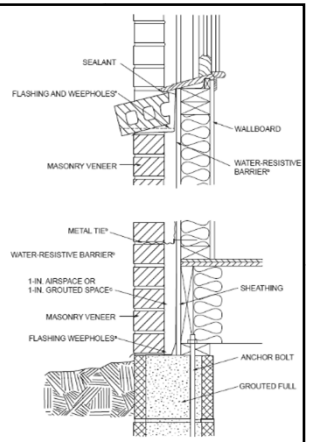


FIGURE R703.8
TYPICAL MASONRY VENEER WALL DETAILS

OTHER TYPES OF JOINTS

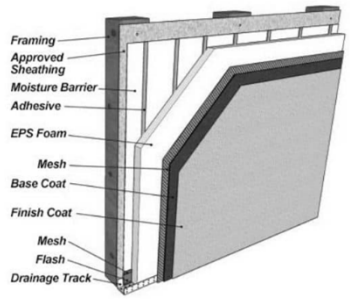
R703.3, R703.10, R703.11, Table 703.3(1)

- In the absence of recommendations, the code requires a minimum lap of 1 inch to 1¼ inches depending on the siding material.
- Follow the manufacture's specifications.

EIFS

R703.9

- DRAINAGE is required to remove moisture trapped behind the EIFS to the exterior.
- FACE NAILING of trim through the EIFS is not permitted. This is to protect the integrity of the weather repellant surface and prevent moisture penetration.
- MINIMUM CLEARANCE is 6-inch between the ground and the lowest edge of the EIFS.
- MANUFACTURER'S INSTRUCTIONS must be followed.



- In the absence of recommendations, the code requires a minimum lap of 1 inch to 1¼ inches for T&G siding.
- Follow the manufacture's specifications.
- Lap siding without tongue-and groove end joints must be :
  - Sealed with caulk
  - Covered with H-joint cover
  - or designed per section 703.1

FIBER CEMENT SIDING

R703.10.2

VINYL SIDING

R703.11

- Vinyl siding must bear a label, which means that the manufacturer must have regular inspections by a third-party quality control agency.
- Follow the manufacture's specifications.

R703.11 Vinyl siding. Vinyl siding shall be certified and *labeled* as conforming to the requirements of ASTM D3679 by an *approved* quality control agency.

R703.11.1 Installation. Vinyl siding, soffit and accessories shall be installed in accordance with the manufacturer's instructions.

R703.11.1.1 Fasteners. Deleted.

R703.11.1.2 Penetration depth. Deleted.

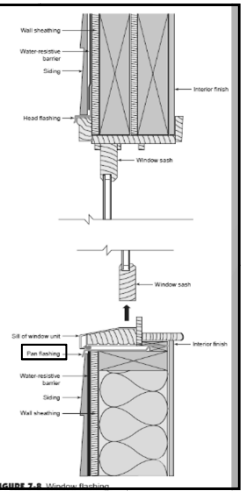
R703.11.1.3 Spacing. Deleted.

R703.11.1.4 Vinyl soffit panels. Soffit panels shall be individually fastened to a supporting component such as a nailing strip, fascia or subfascia component or as specified by the manufacturer's instructions.

R703.11.2.3 Manufacturer specification. Where the vinyl siding manufacturer's product specifications provide an *approved* design wind pressure rating for installation over foam plastic sheathing, use of this design wind pressure rating shall be permitted and the siding shall be installed in accordance with the manufacturer's instructions.

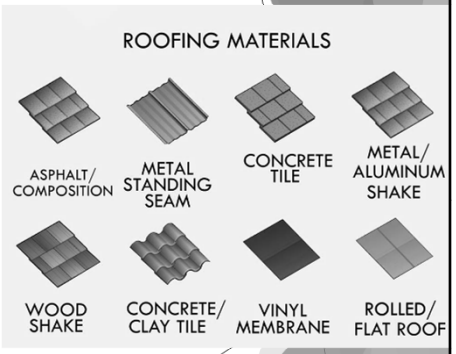
WINDOWS
R609, R703.4

- Installation must follow the manufacturer's instruction.
- The code requires the manufacturer to provide installation and flashing detail instructions with each window and exterior door.
- If installation instructions are not available, the code requires pan flashing.



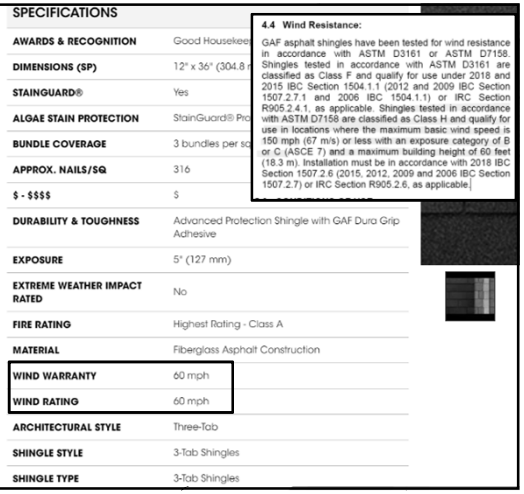
ROOF COVERINGS
R905.1.1

- Installation must follow the manufacturer's instruction.



Warranty vs. Code
R905.1.1

- Example: Three-tab asphalt shingles are typically rated for 150 mph (basic speed) which is far more than the required 90 mph (basic speed) required by NC code. (Refer to NCRC Table R905..2.4.1).
- However, most manufacturers will only provide a warranty of 60 mph.
- The inspections department regulates the minimum code requirements of the product as it was tested.
- The product's warranty coverage is up to the consumer.



SPECIFICATIONS

AWARDS & RECOGNITION	Good Housekeep
DIMENSIONS (SP)	12" x 36" (304.8
STAINGUARD®	Yes
ALGAE STAIN PROTECTION	StainGuard® Pro
BUNDLE COVERAGE	3 bundles per sq
APPROX. NAILS/SQ	316
$ - $$$$	$
DURABILITY & TOUGHNESS	Advanced Protection Shingle with GAF Dura Grip Adhesive
EXPOSURE	5" (127 mm)
EXTREME WEATHER IMPACT RATED	No
FIRE RATING	Highest Rating - Class A
MATERIAL	Fiberglass Asphalt Construction
WIND WARRANTY	60 mph
WIND RATING	60 mph
ARCHITECTURAL STYLE	Three-Tab
SHINGLE STYLE	3-Tab Shingles
SHINGLE TYPE	3-Tab Shingles

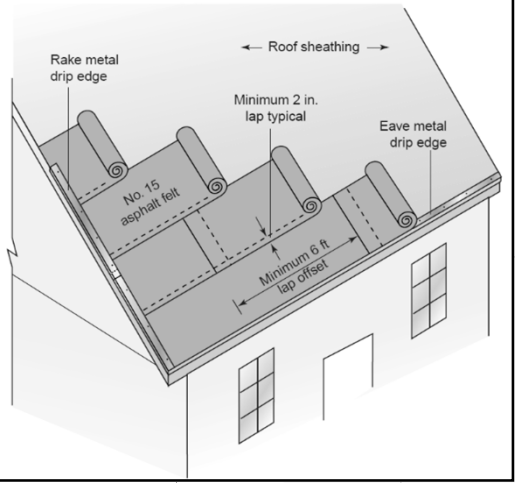
4.4 Wind Resistance:

GAF asphalt shingles have been tested for wind resistance in accordance with ASTM D3161 or ASTM D7158. Shingles tested in accordance with ASTM D3161 are classified as Class F and qualify for use under 2018 and 2015 IBC Section 1504.1.1 (2012 and 2009 IBC Section 1507.2.7.1 and 2006 IBC 1504.1.1) or IRC Section R905.2.4.1, as applicable. Shingles tested in accordance with ASTM D7158 are classified as Class H and qualify for use in locations where the maximum basic wind speed is 150 mph (67 m/s) or less with an exposure category of B or C (ASCE 7) and a maximum building height of 60 feet (18.3 m). Installation must be in accordance with 2018 IBC Section 1507.2.6 (2015, 2012, 2009 and 2006 IBC Section 1507.2.7) or IRC Section R905.2.6, as applicable.

UNDERLAYMENT
R905.1.1

Slopes of 4:12 or grater require:

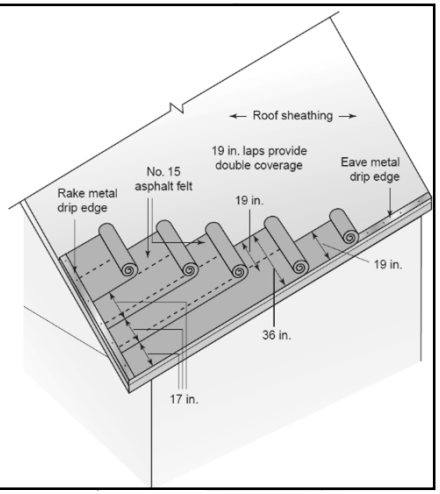
- One layer of No. 15 asphalt-saturated organic felt with 2-inch laps.



UNDERLAYMENT
R905.1.1

Slopes of at least 2:12 and less than 4:12 require:

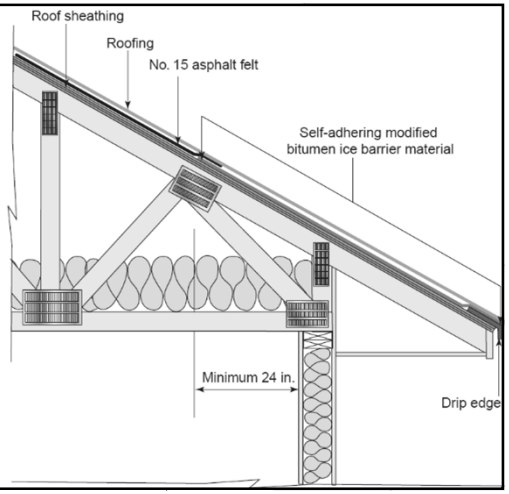
- Two layers of felt with 19-inch horizontal overlaps



ICE BARRIERS
R905.1.1

Ice dams in gutters and along eaves, can force water back under shingles and underlayment.

Two Types:
- Self-adhering polymer-modified bitumen.
- Two layers of cemented underlayment (24" min.)



FLASHING – REQUIRED AREAS
R905.1.1

Improper installation of flashing is the greatest cause roof covering failures. Wherever one plane of a roof intersects another plane, flashing is required.

- Roof & wall intersections.
- Points of change in slope or direction.
- Around roof openings or penetrations.

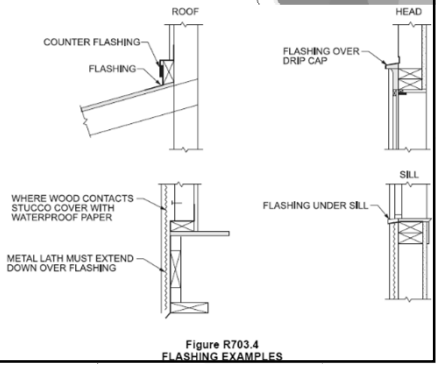
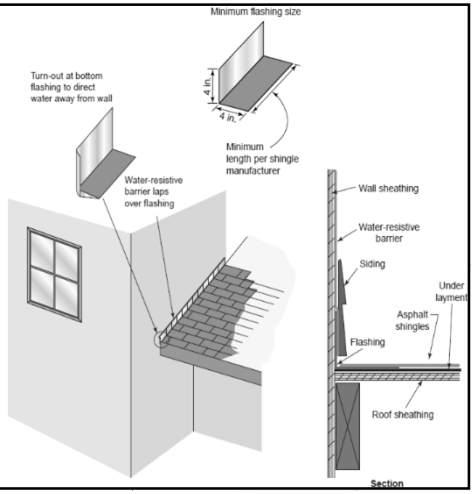


Figure R703.4
FLASHING EXAMPLES

FLASHING - INSTALLATION
R905.1.1

May be provided by:

1. Overlapping individual flashings at each course of shingles.
2. Continuous flashing.



FLASHING - THICKNESS
R903.2.1

- Corrosion-resistant metal at least 0.019 inch thick (No. 26 galvanized sheet).

"Thickness shall be ordered to decimal or fractional thickness. The use of the gauge number is discouraged as being an archaic term of limited usefulness not having a general agreement on meaning."

– American Society for Testing and Materials (ASTM) International

No. 26 - U.S. Standard Gauge (.0188")
VS.
No. 26 – American Wire (aka) B & S (Brown and Sharpe) (.0159")

Standard sheet metal gauges for Specific Engineering Materials

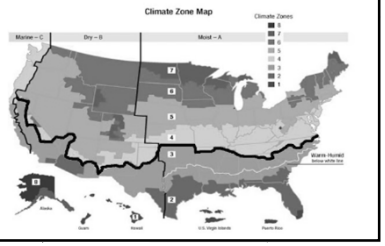
Gauge	Steel in (mm)	Galvanized steel in (mm)	Stainless steel in (mm)	Aluminum in (mm)	Zinc in (mm)
26	0.0179 (0.45)	0.0217 (0.55)	0.019 (0.48)	0.017 (0.43)	-

FLASHING - CHIMNEYS
R903.2.1

Any chimney penetration more than 30 inches wide requires a cricket or saddle to divert water from the roof above to each side of the chimney.

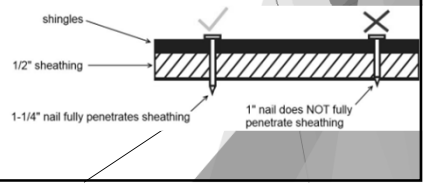
ASPHALT SHINGLES
R905.2

- Require a roof slope of at least 2:12
- Must be installed in accordance with the manufacturer's instructions and per climate zone.



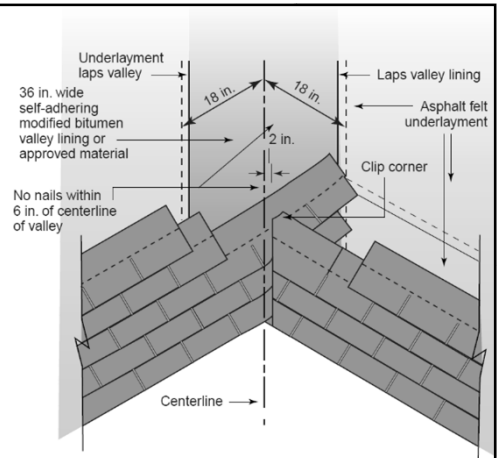
ASPHALT SHINGLES - FASTENERS
R905.2

- Fasteners must be galvanized steel, stainless steel, aluminum, or copper roofing nails of at least 12 gauge (0.105 inch) with a head diameter not less than ⅜ inch.
- Nails must penetrate at least ¾ inch into the roof sheathing or penetrate through the sheathing



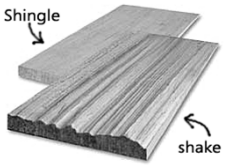
CLOSED VALLEYS
R905.2

Require one of the following:
- (1) self-adhering polymer-modified bitumen sheet. (ice-water shield)
- (1) 24-inch-wide metal valley.
- (1) ply of approved smooth roll roofing at least 36" wide.
- (2) plies of mineral surfaced roll roofing.



Cut closed valley option for asphalt shingles

WOOD SHINGLES VS. WOOD SHAKES
R905.7, R905.8



SHINGLES
- Uniform, thin and flat.
- No felt paper required.
- 3:12 minimum slope
- 3/8" Thick

SHAKES
- Irregular, thick, rustic.
- Felt paper required. (R905.8.7)
- 1/2"-3/4" Thick.

WOOD SHINGLES VS. WOOD SHAKES
R905.7, R905.8

* See tables R905.7.5(1) and R905.7.5(2) to determine the maximum allowed exposure.

Example:
- For a 24-in. taper –sawn cedar shake, with a roof slope equal or greater than 4:12 the maximum exposure is 7½ in. (Taper-sawn is a hybrid, sawn on all sides but it's thicker than a shake).

TABLE R905.7.5(1)
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3 1/4	5
		No. 2	3 1/2	4
		No. 3	3	3 1/2
	18	No. 1	4 1/4	5 1/2
		No. 2	4	4 1/2
		No. 3	3 1/2	4
	24	No. 1	5 3/4	7 1/2
		No. 2	5 1/2	6 1/2
		No. 3	5	5 1/2

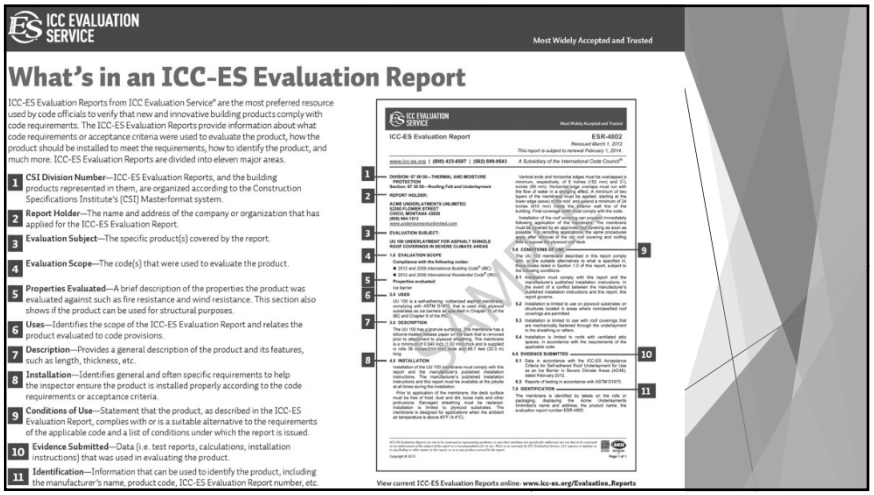
TABLE R905.8.6
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)
			4:12 pitch or steeper
Shakes of naturally durable wood	18	No. 1	7 1/2
	24	No. 1	10
Preservative-treated tapersawn shakes of Southern Yellow Pine	18	No. 1	7 1/2
	24	No. 1	10
	18	No. 2	5 1/2
	24	No. 2	7 1/2
Taper-sawn shakes of naturally durable wood	18	No. 1	7 1/2
	24	No. 1	10
	18	No. 2	5 1/2
	24	No. 2	7 1/2

NEW OR UNUSUAL FINISH MATERIALS

NEW OR UNUSUAL FINISH MATERIALS AND/OR FASTENERS

- Sometimes the codes have not adopted provisions for new or unusual building materials.
- In those cases it is important to submit standards, manufacturer's specifications and/or product data sheets for approval by the CEO.
- If an ESR report can be used to show equivalent code compliance. When using an ESR report, it shall be printed on the construction plans. (Just like a UL-design)



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Most Widely Accepted and Trusted

What's in an ICC-ES Evaluation Report

ICC-ES Evaluation Reports from ICC Evaluation Service® are the most preferred resource used by code officials to verify that new and innovative building products comply with code requirements. The ICC-ES Evaluation Reports provide information about what code requirements or acceptance criteria were used to evaluate the product, how the product should be installed to meet the requirements, how to identify the product, and much more. ICC-ES Evaluation Reports are divided into eleven major areas.

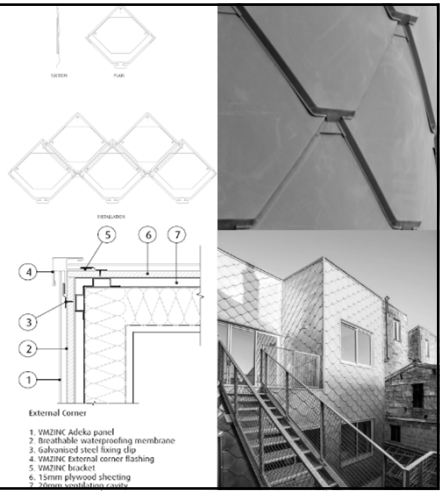
1. **CSI Division Number**—ICC-ES Evaluation Reports, and the building products represented in them, are organized according to the Construction Specifications Institute's (CSI) Masterformat system.
2. **Report Holder**—The name and address of the company or organization that has applied for the ICC-ES Evaluation Report.
3. **Evaluation Subject**—The specific product(s) covered by the report.
4. **Evaluation Scope**—The code(s) that were used to evaluate the product.
5. **Properties Evaluated**—A brief description of the properties the product was evaluated against such as fire resistance and wind resistance. This section also shows if the product can be used for structural purposes.
6. **Uses**—Identifies the scope of the ICC-ES Evaluation Report and relates the product evaluated to code provisions.
7. **Description**—Provides a general description of the product and its features, such as length, thickness, etc.
8. **Installation**—Identifies general and often specific requirements to help the inspector ensure the product is installed properly according to the code requirements or acceptance criteria.
9. **Conditions of Use**—Statement that the product, as described in the ICC-ES Evaluation Report, complies with or is a suitable alternative to the requirements of the applicable code and a list of conditions under which the report is issued.
10. **Evidence Submitted**—Data (i.e. test reports, calculations, installation instructions) that was used in evaluating the product.
11. **Identification**—Information that can be used to identify the product, including the manufacturer's name, product code, ICC-ES Evaluation Report number, etc.

View current ICC-ES Evaluation Reports online: **www.icc-es.org/Evaluation_Reports**

METAL SHINGLE

R905.7, R905.8

- Factory-formed, zinc-alloy, metal tiles/wall panel system with concealed fasteners.
- Used on roofs (≥3:12) or walls.
- Panel Dimensions (vary)
- -16" vertical
  -22" horizontal
  -2" overlap
- Provisions for copper shingles on the NCRC & NCBC



POLY-ASH SIDING (i.e. Boral)

R905.7, R905.8

- Made with fly-ash, a by-product recovered from coal combustion. When fly-ash is combined with polymers, it becomes a durable material that's ideally suited for exterior siding and trim.
- High resistance to moisture and movement. Dimensionally stable. Realistic wood look.

ACCESSIBILITY

Chapter 11 - NC Building Code

ACCESSIBILITY IN RESIDENTIAL PROJECTS

NCBC 1104.2, 1105.1

When is accessibility required residential projects?

ACCESSIBILITY IN RESIDENTIAL PROJECTS

NCBC 1104.2, 1105.1

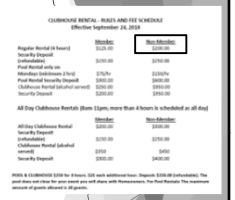
- Sales Centers.
- Townhome buildings with ≤ 4 units.
- Townhome buildings with elevators.
- The accessible route between the parking and the sales center.
- Accessible route between multiple model homes when no equivalent facilitation is provided to select design features.
- Public accommodations.

ACCESSIBILITY IN RESIDENTIAL PROJECTS

NCBC 1104.2, 1105.1

What are public accommodations?

- Areas open to people other than residents and their guests.



MODEL HOMES

Chapter 11 - NC Building Code

MODEL HOME

NCBC1104.2, 1105.1

- The residential part of the model home is exempt from accessibility provisions. Only the sales center (i.e. garage) is required to be accessible. Equivalent facilitation is required.
- A model home is not considered a place of public accommodation.

MODEL HOME

NCBC1104.2, 1105.1

Access to the models and to the upper floors is allowed to be provided by equivalent facilitation, such as:

- Brochures
- Photos
- Videos
- Virtual Tours

SALES OFFICE

Chapter 11 - NC Building Code

SALES OFFICE PARKING
NCBC1104.2, 1105.1

When parking spaces are required by zoning, an accessible parking space will be required, along with an accessible route to the entrance.

SALES OFFICE ENTRY DOOR
NCBC1104.2, 1105.1

- The entry door to the Sales office is required to be accessible.
  - Width
  - Threshold
  - Door hardware
  - Operating pressure (5 lbs. max.)

EASY WAYS TO PROVIDE AN ACCESSIBLE ROUTE THE MODEL

Although access to the model is not required when equivalent facilitation is provided, providing access is to the first floor can be easily achieved by:

- Removing doors.
- Installing offset hinges.
- Adding a temporary ramp
- Adding a temporary "plug-in" lift

INSIDE THE SALES OFFICE
NCBC1104.2, 1105.1

- As with any other public accommodation, the user should be able to approach enter and exit the office.

KITCHENS INSIDE THE SALES OFFICE

NCBC1104.2, 1105.1

- Model kitchens are not required to be accessible.
- However, if a model kitchen is provided for employee and/or public use, then it should be designed to be accessible.

TOILETS INSIDE THE SALES OFFICE

NCBC1104.2, 1105.1

- Toilets inside the sales office/or model home are not required to be accessible.
- However, if a toilet is provided for employee and/or public use, then it should be designed to be accessible.

PORT-A-POTTIES

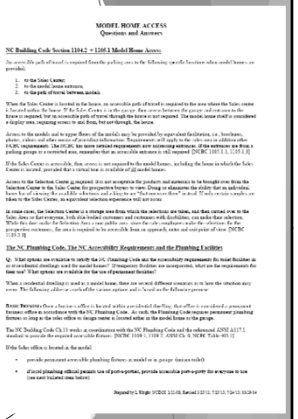
NCBC1104.2, 1105.1

- Able-bodied personnel cannot use permanent fixtures in house and have persons with disabilities use accessible port-a-potty.
- When a port-a-potty is provided, the water supply to the fixtures should be shut off.
- An "out of order" sign is not allowed.

Frequently Asked Questions

NCDOI has document on their website that answers the most FAQ on accessibility.

- https://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/Code_Enforcement_Resources/Handouts-Specific Topics/Model Home Access_.pdf



MODEL HOME ACCESS
Questions and Answers

NC Building Code Section 1104.2 + 1105.1 Model Home Access:

TOWNHOMES (≤4 Units)

Chapter 11 - NC Building Code

TOWNHOMES

R320

SECTION R320
ACCESSIBILITY

R320.1 Scope. Where there are four or more *dwelling units* or sleeping units in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply.

R320.1.1 Guestrooms. Deleted.

1107.6.3 Group R-3. In Group R-3 occupancies where there are four or more *dwelling units* or *sleeping units intended to be occupied as a residence* in a single structure, every *dwelling unit* and *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*. Bedrooms within congregate living facilities shall be counted as *sleeping units* for the purpose of determining the number of units.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1107.7.

There are two townhome layouts that require (type B) accessibility requirements:

1. Four or more single story units within the same roof.
2. Any multistory unit with an elevator.

TYPE B - REQUIREMENTS

ANSI A117.1 - 1004

1004.1 Primary entrance
1004.3 Accessible Route
1004.4 Changes in level
1004.5 Doors and Doorways

1004.6 Ramps
1004.7 Elevators
1004.8 Lifts

1004.9 Operable Parts
1004.10 Laundry Equipment
1004.11 Toilet and Bathing Facilities
1004.12 Kitchens and Kitchenettes

1004.1 General. Type B units shall comply with Section 1004.

1004.2 Primary Entrance. The accessible primary entrance shall be on an accessible route from public and common areas. The primary entrance shall not be to a bedroom unless it is the only entrance.

1004.3 Accessible Route. Accessible routes within Type B units shall comply with Section 1004.3.

1004.3.1 Location. At least one accessible route shall connect all spaces and elements that are a part of the unit. Accessible routes shall coincide with or be located in the same area as a general circulation path.

EXCEPTIONS:
1. An accessible route is not required to unfinished attics and unfinished basements that are part of the unit.
2. One of the following is not required to be on an accessible route:
   2.1 A raised floor area in a portion of a living, dining, or sleeping room; or
   2.2 A sunken floor area in a portion of a living, dining, or sleeping room; or
   2.3 A mezzanine that does not have plumbing fixtures or an enclosed habitable space.

1004.3.2 Components. Accessible routes shall consist of one or more of the following elements: walking surfaces with a slope not steeper than 1:20, doors and doorways, ramps, elevators, and platform lifts.

1004.4 Walking Surfaces. Walking surfaces that are part of an accessible route shall comply with Section 1004.4.

1004.4.1 Clear Width. Clear width of an accessible route shall comply with Section 403.5.

1004.4.2 Changes in Level. Changes in level shall comply with Section 303.

EXCEPTION: Where exterior deck, patio or balcony surface materials are impervious, the finished exterior impervious surface shall be 4 inches (100 mm) maximum below the floor level of the adjacent interior spaces of the unit.

1004.5 Doors and Doorways. Doors and doorways shall comply with Section 1004.5.

1004.5.1 Primary Entrance Door. The primary entrance door to the unit shall comply with Section 404.

EXCEPTION: (see below)

Storm and screen doors serving individual dwelling or sleeping units are not required to comply with Section 404.2.5.

1004.5.2 User Passage Doorways. Doorways intended for user passage shall comply with Section 1004.5.2.

1004.5.2.1 Clear Width. Doorways shall have a clear opening of 31 3/4 inches (810 mm) minimum. Clear opening of swinging doors shall be measured between the face of the door and stop, with the door open 90 degrees.

1004.5.2.1.1 Double Leaf Doorways. Where the operable parts on an inactive leaf of a double leaf doorway are located more than 48 inches (1220 mm) or less than 15 inches (380 mm) above the floor, the active leaf shall provide the clearance required by Section 1004.5.2.1.

1004.5.2.2 Thresholds. Thresholds shall comply with Section 303.
EXCEPTION: Thresholds at exterior sliding doors shall be permitted to be 3/4 inch (19 mm) maximum in height, provided they are beveled with a slope not steeper than 1:2.

1004.5.2.3 Automatic Doors. Automatic doors shall comply with Section 404.3.

1004.6 Ramps. Ramps shall comply with Section 405.

1004.7 Elevators. Elevators within the unit shall comply with Section 407, 408, or 409.

1004.8 Platform Lifts. Platform lifts within the unit shall comply with Section 410.

1004.9 Operable Parts. Lighting controls, electrical switches and receptacle outlets, environmental controls, electrical panelboards, and user controls for security or intercom systems shall comply with Sections 309.2 and 309.3.

EXCEPTIONS:
1. Receptacle outlets serving a dedicated use.
2. Where two or more receptacle outlets are provided in a kitchen above a length of counter top that is uninterrupted by a sink or appliance, one receptacle outlet shall not be required to comply with Section 309.
3. Floor receptacle outlets.
4. HVAC diffusers.
5. Controls mounted on ceiling fans.
6. Controls or switches mounted on appliances.
7. Plumbing fixture controls.
9. Where redundant controls other than light switches are provided for a single element, one control in each space shall not be required to be accessible.

8. Reset buttons and shut-offs serving appliances, piping and plumbing fixtures.
10. Within kitchens and bathrooms, lighting controls, electrical switches and receptacle outlets are permitted to be located over cabinets with counter tops 36 inches (915 mm) maximum in height and 25-1/2 inches (650 mm) maximum in depth.

(note numbers are reordered to show similarities and improve readability)

1004.10 Laundry Equipment. Washing machines and clothes dryers shall comply with Section 1004.10.

1004.10.1 Clear Floor Space. A clear floor space complying with Section 305.3, shall be provided. A parallel approach shall be provided for a top loading machine. A forward or parallel approach shall be provided for a front loading machine.

1004.11 Toilet and Bathing Facilities. Toilet and bathing fixtures shall comply with Section 1004.11.

EXCEPTION: Fixtures on levels not required to be accessible.

1004.11.1 Grab Bar and Shower Seat Reinforcement. Reinforcement shall be provided for the future installation of grab bars and shower seats at water closets, bathtubs, and shower compartments. Where walls are located to permit the installation of grab bars and seats complying with Section 604.5 at water closets; grab bars complying with Section 607.4 at bathtubs; and for grab bars and shower seats complying with Sections, 608.3, 608.2.1.3, 608.2.2.3 and 608.2.3.2 at shower compartments; reinforcement shall be provided for the future installation of grab bars and seats complying with those requirements.

EXCEPTIONS:

1. In a room containing only a lavatory and a water closet, reinforcement is not required provided the room does not contain the only lavatory or water closet on the accessible level of the unit.
2. At water closets reinforcement for the side wall vertical grab bar component required by Section 604.5 is not required.
3. At water closets where wall space will not permit a grab bar complying with Section 604.5.2, reinforcement for a rear wall grab bar 24 inches (610 mm) minimum in length centered on the water closet shall be provided.
4. At water closets where a side wall is not available for a 42-inch (1065 mm) grab bar complying with 604.5.1, reinforcement for a sidewall grab bar, 24 inches (610 mm) minimum in length, located 12 inches (305 mm) maximum from the rear wall, shall be provided.
5. At water closets where a side wall is not available for a 42- inch (1065 mm) grab bar complying with Section 604.5.1 reinforcement for a swing-up grab bar complying with Section 1004.11.1.1 shall be permitted.
6. At water closets where a side wall is not available for a 42-inch (1065 mm) grab bar complying with 604.5.1 reinforcement for two swing-up grab bars complying with Section 1004.11.1.1 shall be permitted to be installed in lieu of reinforcement for rear wall and side wall grab bars.
7. In shower compartments larger than 36 inches (915 mm) in width and 36 inches (915 mm) in depth reinforcement for a shower seat is not required.

1004.11.1.1 Swing–up Grab Bars. A clearance of 18 inches (455 mm) minimum from the centerline of the water closet to any side wall or obstruction shall be provided where reinforcement for swing–up grab bars is provided. When the approach to the water closet is from the side, the 18 inches (455 mm) minimum shall be on the side opposite the direction of approach. Reinforcement shall accommodate a swing–up grab bar centered 15-3/4 inches (400 mm) from the centerline of the water closet and 28 inches (710 mm) minimum in length, measured from the wall to the end of the horizontal portion of the grab bar. Reinforcement shall accommodate a swing-up grab bar with a height in the down position of 33 inches (840 mm) minimum and 36 inches (915 mm) maximum. Reinforcement shall be adequate to resist forces in accordance with Section 609.8.

EXCEPTION: Where a water closet is positioned with a wall to the rear and to one side, the centerline of the water closet shall be 16 inches (405 mm) minimum and 18 inches (455 mm) maximum from the sidewall.

1004.11.2 Clear Floor Space. Clear floor spaces required by Section 1004.11.3.1 (Option A) or 1004.11.3.2 (Option B) shall comply with Sections 1004.11.2 and 305.3.

1004.11.2.1 Doors. Doors shall not swing into the clear floor space or clearance for any fixture.

EXCEPTION: Where a clear floor space complying with Section 305.3, excluding knee and toe clearances under elements, is provided within the room beyond the arc of the door swing.

1004.11.2.2 Knee and Toe Clearance. Clear floor space at fixtures shall be permitted to include knee and toe clearances complying with Section 306.

1004.11.3 Toilet and Bathing Areas. Either all toilet and bathing areas provided shall comply with Section 1004.11.3.1 (Option A), or one toilet and bathing area shall comply with Section 1004.11.3.2 (Option B).

1004.11.3.1 Option A. Each fixture provided shall comply with Section 1004.11.3.1.

EXCEPTIONS:

1. Where multiple lavatories are provided in a single toilet and bathing area such that travel between fixtures does not require travel through other parts of the unit, not more than one lavatory is required to comply with Section 1004.11.3.1.
2. A lavatory and a water closet in a room containing only a lavatory and a water closet, provided the room does not contain the only lavatory or water closet on the accessible level of the unit.

1004.11.3.2 Option B. One of each type of fixture provided shall comply with Section 1004.11.3.2. The accessible fixtures shall be in a single toilet/bathing area, such that travel between fixtures does not require travel through other parts of the unit.

1004.12 Kitchens and kitchenettes. Kitchens and kitchenettes shall comply with Section 1004.12.

1004.12.1 Clearance. Clearance complying with Section 1004.12.1 shall be provided.

1004.12.1.1 Minimum Clearance. Clearance between all opposing base cabinets, counter tops, appliances, or walls within kitchen work areas shall be 40 inches (1015mm) minimum.

1004.12.1.2 U-Shaped Kitchens. In kitchens with counters, appliances, or cabinets on three contiguous sides, clearance between all opposing base cabinets, countertops, appliances, or walls within kitchen work areas shall be 60 inches (1525 mm) minimum.

1004.12.2 Clear Floor Space. Clear floor space at appliances shall comply with Sections 1004.12.2 and 305.3.

1004.12.2.1 Sink. A clear floor space, positioned for a parallel approach to the sink, shall be provided. The clear floor space shall be centered on the sink bowl.

EXCEPTION: A sink with a forward approach complying with Section 1003.12.4.1.

1004.12.2.2 Dishwasher. A clear floor space, positioned for a parallel or forward approach to the dishwasher, shall be provided. The dishwasher door in the open position shall not obstruct the clear floor space for the dishwasher.

1004.12.2.3 Cooktop. Cooktops shall comply with Section 1004.12.2.3.

1004.12.2.3.1 Approach. A clear floor space, positioned for a parallel or forward approach to the cooktop, shall be provided.

1004.12.2.3.2 Forward approach. Where the clear floor space is positioned for a forward approach, knee and toe clearance complying with Section 306 shall be provided. The underside of the cooktop shall be insulated or otherwise configured to prevent burns, abrasions, or electrical shock.

1004.12.2.3.3 Parallel approach. Where the clear floor space is positioned for a parallel approach, the clear floor space shall be centered on the appliance.

1004.12.2.4 Oven. A clear floor space, positioned for a parallel or forward approach adjacent to the oven shall be provided. The oven door in the open position shall not obstruct the clear floor space for the oven.

1004.12.2.5 Refrigerator/Freezer. A clear floor space, positioned for a parallel approach to the refrigerator/freezer, shall be provided. The centerline of the clear floor space shall be offset 24 inches (610 mm) maximum from the centerline of the appliance.

1004.12.2.6 Trash Compactor. A clear floor space, positioned for a parallel or forward approach to the trash compactor, shall be provided.

Toilet & Bathing Facilities Comparison

Option A vs. Option B

1004 TYPE B DWELLING UNITS

OPTION A	OPTION B
1004.11.3 Toilet and Bathing Areas. Either all toilet and bathing areas provided shall comply with Section 1004.11.3.1 (Option A), or one toilet and bathing area shall comply with Section 1004.11.3.2 (Option B).	
1004.11.3.1 Option A. Each fixture provided shall comply with Section 1004.11.3.1. **EXCEPTIONS:** 1. Where multiple lavatories are provided in a single toilet and bathing area such that travel between fixtures does not require travel through other parts of the unit, not more than one lavatory is required to comply with Section 1004.11.3.1. 2. A lavatory and a water closet in a room containing only a lavatory and water closet, provided the room does not contain the only lavatory or water closet on the accessible level of the unit.	**1004.11.3.2 Option B.** One of each type of fixture provided shall comply with Section 1004.11.3.2. The accessible fixtures shall be in a single toilet/bathing area, such that travel between fixtures does not require travel through other parts of the unit.
1004.11.3.1.1 Lavatory. A clear floor space complying with Section 305.3, positioned for a parallel approach, shall be provided at a lavatory. The clear floor space shall be centered on the lavatory. **EXCEPTION:** A lavatory complying with Section 606 shall be permitted. Cabinetry shall be permitted under the lavatory provided the following criteria are met: (a) The cabinetry can be removed without removal or replacement of the lavatory; and (b) The floor finish extends under	**1004.11.3.2.1 Lavatory.** Lavatories shall comply with Sections 1004.11.3.1.1 and 1004.11.3.2.1. *Same as option A, plus height requirement below.*

1004 TYPE B DWELLING UNITS

OPTION A	OPTION B
the cabinetry, and (c) The walls behind and surrounding the cabinetry are finished.	
	1004.11.3.2.1.1 Height. The front of the lavatory shall be 34 inches (865 mm) maximum above the floor, measured to the higher of the rim or counter surface.
1004.11.3.1.2 Water Closet. The water closet shall comply with Section 1004.11.3.1.2.	**1004.11.3.2.2 Water Closet.** The water closet shall comply with Section 1004.11.3.1.2.
1004.11.3.1.2.1 Location. The centerline of the water closet shall be 16 inches (405 mm) minimum and 18 inches (455 mm) maximum from one side of the required clearance.	*Same as Option A*
1004.11.3.1.2.2 Clearance. Clearance around the water closet shall comply with Sections 1004.11.3.1.2.2.1 through 1004.11.3.1.2.2.3. **EXCEPTION:** Clearance complying with Sections 1003.11.2.4.2 through 1003.11.2.4.4.	*Same as Option A*
1004.11.3.1.2.2.1 Clearance Width. Clearance around the water closet shall be 48 inches (1220 mm) minimum in width, measured perpendicular from the side of the clearance that is 16 inches (405 mm) minimum and 18 inches (455 mm) maximum from the water closet centerline.	*Same as Option A*
1004.11.3.1.2.2.2 Clearance Depth. Clearance around the water closet shall be 56 inches (1420 mm) minimum in depth, measured perpendicular from the rear wall.	*Same as Option A*
1004.11.3.1.2.2.3 Increased Clearance Depth at Forward Approach. Where a forward approach is provided, the clearance	*Same as Option A*

1004 TYPE B DWELLING UNITS

OPTION A	OPTION B
shall be 66 inches (1675 mm) minimum in depth, measured perpendicular from the rear wall.	
1004.11.3.1.2.2.4 Clearance Overlap. A vanity or other obstruction 24 inches (610 mm) maximum in depth, measured perpendicular from the rear wall, shall be permitted to overlap the required clearance, provided the width of the remaining clearance at the water closet is 33 inches (840 mm) minimum.	*Same as Option A*
1004.11.3.1.3 Bathing Fixtures. Where provided, a bathtub shall comply with Section 1004.11.3.1.1 or 1004.11.3.1.3.2 and a shower compartment shall comply with Section 1004.11.3.1.3.3.	**1004.11.3.2.3 Bathing Fixtures.** The accessible bathing fixture shall be a bathtub complying with Section 1004.11.3.2.3.1 or a shower compartment complying with Section 1004.11.3.2.3.2.
	1004.11.3.2.3.1 Bathtub. A clearance 48 inches (1220 mm) minimum in length measured perpendicular from the control end of the bathtub, and 30 inches (760 mm) minimum in width shall be provided in front of bathtubs.

1004 TYPE B DWELLING UNITS	
OPTION A	OPTION B
1004.11.3.1.3.1 Parallel Approach Bathtubs. A clearance 60 inches (1525 mm) minimum in length and 30 inches (760 mm) minimum in width shall be provided in front of bathtubs with a parallel approach. Lavatories complying with Section 606 shall be permitted in the clearance. A lavatory complying with Section 1004.11.3.1.1 shall be permitted at one end of the bathtub if a clearance 48 inches (1220 mm) minimum in length and 30 inches (760 mm) minimum in width is provided in front of the bathtub.	
1004.11.3.1.3.2 Forward Approach Bathtubs. A clearance 60 inches (1525 mm) minimum in length and 48 inches (1220 mm) minimum in width shall be provided in front of bathtubs with a forward approach. A water closet and a lavatory shall be permitted in the clearance at one end of the bathtub.	
1004.11.3.1.3.3 Shower Compartment. If a shower compartment is the only bathing facility, the shower compartment shall have dimensions of 36 inches (915 mm) minimum in width and 36 inches (915 mm) minimum in depth. A clearance of 48 inches (1220 mm) minimum in length, measured perpendicular	**1004.11.3.2.3.2 Shower Compartment.** A shower compartment shall comply with Section 1004.11.3.1.3.3. *Same as Option A*

1004 TYPE B DWELLING UNITS	
OPTION A	OPTION B
from the shower head wall, and 30 inches (760 mm) minimum in depth, measured from the face of the shower compartment, shall be provided. Reinforcing for a shower seat is not required in shower compartments larger than 36 inches (915 mm) in width and 36 inches (915 mm) in depth.	

IN-HOME DAYCARES

2018 NC Building Code

SMALL RESIDENTIAL CARE FACILITIES

NCBC 428.2

NCBC 428.2 AND 428.3 are two NC amendments that state that care facilities can be classified as single-family residences per the NC Residential Code.

NO sprinklers, and NO accessibility is required.

428.2 Residential care homes. Homes keeping no more than six adults or six unrestrained children who are able to respond and evacuate the facility without assistance, determined by the state agency having jurisdiction to be licensable, shall be classified as single-family residential (*North Carolina Residential Code*).

428.2.1 Means of egress. Each normally occupied story of the facility shall have two remotely located means of egress exits.

428.2.2 Smoke detection systems. Smoke detectors shall be provided on all levels per the *North Carolina Residential Code*.

428.2.3 Interior finishes. Interior wall and ceiling finishes shall be Class A, B or C.

428.2.4 Heating appliances. Untented fuel-fired heaters and portable electric heaters shall be prohibited.

428.3 Licensed small residential care facilities. The following facilities when determined by the State Agency having jurisdiction to be licensable, shall be classified as single-family residential.

1. Residential care facilities keeping no more than six adults or six unrestrained children with no more than three who are unable to respond and evacuate without assistance.
2. Residential care facilities keeping no more than five adults or five children who are unable to respond and evacuate without assistance, when certifiable for Medicaid reimbursement, and when staffed 24-hours per day with at least two staff awake at all times.
3. Residential care facilities keeping no more than nine adults or nine children who are able to respond and evacuate without assistance.

2020 CALENDAR

MCCE - Residential Training
2020 Calendar
2145 Suttle Ave. Charlotte, NC 8:00 am – 12:00 pm Last Updated: 11/22/2019

DATES	TOPIC	DESCRIPTION
1/8/2019	OUTSIDE TRAINING (2 hrs.)	Dan Scullion from Simpson Strong Tie will present: • 2018 NCRC Appendix W - Decks
	OUTSIDE TRAINING (2 hrs.)	Watties Greene From NCLGBC will present: • Legislative updates from the NC Licensing Board for General Contractors.
2/5/2020	STRUCTURAL DESIGN (2 hrs.)	Climatic and geographical design criteria, prescriptive and performance design, basic loads, wind, snow, seismic and flood loads.
	SITE DEVELOPMENT (2 hrs.)	Site development, location on property, fire separation distance, soils and fills, site preparation, footings, foundations, rebar inspections and storm drainage.
3/4/2020	FIRE SAFETY (2 hrs.)	Fire resistance, dwelling separation, floor fire protection, foam plastic, sprinklers, smoke alarms, chimneys, and fireplaces.
	HOME SAFETY (2hrs.)	Room areas, ceiling heights, fall protection, safety glass, means of egress, emergency escape and rescue openings.
4/1/2020	FINISHES (2hrs.)	Interior and exterior finishes, roof coverings, weather protection and masonry design.
	DECKS (2hrs.)	Construction requirements and documentation. Common deck failures, fasteners, hanger hardware, ledger connections, guard rail and guard post attachments, footers, beams, columns, stairways, and pressure treated wood concerns.
5/6/2020	ENERGY CODE (2hrs.)	Prescriptive methods of the NC Residential Code for energy use and conservation.
	ACCESSIBILITY (2hrs.)	Accessibility is not required in the residential code, but there are a few instances where it may come into play such as: townhomes with elevators, townhomes ≥4 units, sales centers, HC parking, etc.
6/3/2020	CODE ADMINISTRATION (2hrs.)	Basic concepts: Code Administration, Plan Review, and Inspections, Permit and Licensing Requirements.
	OTHER BUILDINGS (2hrs.)	Overview of pools & spas, child and adult care facilities, permanent modular, tiny homes, manufactured housing, container units and piers and docks.

MCCE - Residential Training
2020 Calendar
2145 Suttle Ave. Charlotte, NC 8:00 am – 12:00 pm Last Updated: 11/22/2019

DATES	TOPIC	DESCRIPTION
7/6/2020	STRUCTURAL DESIGN (2hrs.)	Climatic and geographical design criteria, prescriptive and performance design, basic loads, wind, snow, seismic and flood loads.
	SITE DEVELOPMENT (2hrs.)	Site development, location on property, fire separation distance, soils and fills, site preparation, footings, foundations, rebar inspections and storm drainage.
8/3/2020	CODE CONNECTIONS (2hrs.)	Annual meeting with home builders, architects and engineers to present process updates, discuss code changes, interpretations, consistency items or any other issues.
9/2/2020	FIRE SAFETY (2hrs.)	Fire resistance, dwelling separation, floor fire protection, foam plastic, sprinklers, smoke alarms, chimneys and fireplaces.
	HOME SAFETY (2hrs.)	Room areas, ceiling heights, fall protection, safety glass, means of egress, emergency escape and rescue openings.
10/7/2020	FINISHES (2hrs.)	Interior and exterior finishes, roof coverings, weather protection and masonry design.
	DECKS (2hrs.)	Construction requirements and documentation. Common deck failures, fasteners, hanger hardware, ledger connections, guard rail and guard post attachments, footers, beams, columns, stairways, and pressure treated wood concerns.
11/4/2020	ENERGY CODE (2hrs.)	Prescriptive methods of the NC Residential Code for energy use and conservation.
	ACCESSIBILITY (2hrs.)	Accessibility is not required in the residential code, but there are a few instances where it may come into play such as: townhomes with elevators, townhomes ≥4 units, sales centers, HC parking, etc.
12/2/2020	CODE ADMINISTRATION (2hrs.)	Basic concepts: Code Administration, Plan Review, and Inspections, Permit and Licensing Requirements.
	OTHER BUILDINGS (2hrs.)	Overview of pools & spas, child and adult care facilities, permanent modular, tiny homes, manufactured housing, container units and piers and docks.

STARTING DECEMBER 2019…

ALL CODE RESIDENTIAL CODE ACADEMY CLASSES WILL HAVE BUILDING CE !

ACCESSORY BUILDINGS

2018 NC Building Code

WORK EXEMPT FROM PERMIT

Accessory buildings, small fences, small retaining walls, sidewalks and driveways, and **many others** are exempt from permit.

▶ WHEN IN DOUBT , **REVIEW STATUTES.**

WORK EXEMPT

However, even if a permit is not required, ALL work must follow the code.

Example:

An accessory building in a flood zone, is required to be above the flood level.

ACCESSORY BUILDINGS

R101.2.1 Accessory buildings. *Accessory buildings* with any dimension greater than 12 feet (3658 mm) shall meet the provisions of this code. *Accessory buildings* are permitted to be constructed without a masonry or concrete foundation, except in *coastal high hazard* or *ocean hazard areas*, provided all of the following conditions are met:

1. The *accessory building* shall not exceed 400 square feet (37 m^2) or one story in height;
2. The building is supported on a wood foundation of minimum 2-inch by 6-inch (51-mm by 152-mm) or 3-inch by 4-inch (76-mm by 102-mm) mudsill of approved wood in accordance with Section R317; and
3. The building is anchored to resist overturning and sliding by installing a minimum of one ground anchor at each corner of the building. The total resisting force of the anchors shall be equal to 20 psf (958 Pa) times the plan area of the building.

ACCESSORY BUILDINGS

QUESTION:

- On an accessory storage building, how is the 12' in any direction measured?

ACCESSORY BUILDINGS

ANSWERS:

- The requirement for a permit is based upon any plan dimension (no overhangs) greater than 12' in any direction including any vertical height that is greater than 12' (measured from grade to mean roof line).
- Many buildings are elevated due to topography or due to the required ground clearances for nontreated joists and subfloor. MCCE allows the following anchoring methods for accessory buildings based upon common engineering practice:

ACCESSORY BUILDINGS

QUESTION:

- Can an accessory storage building be built on stacked blocks; How far apart can they be spaced?

ACCESSORY BUILDINGS

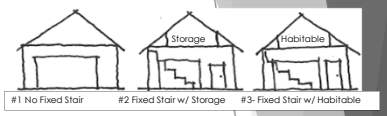
ANSWER PER MCCE's INTERPRETATION:

- Precast solid blocks/footers or cap blocks can be used and dry stacked on grade to maximum of 24".
- A 2x6 or 2x4 mud sill with wood protection per section R317.
- The structure must be 400 square feet or less, one story and tied down at the corners per section R101.2.1 condition #3.
- The maximum span between blocks is 4 feet.

ACCESSORY BUILDINGS

QUESTION:
What are the egress requirements for a single story detached garage, garages with storage above and garages with habitable space above?

ACCESSORY BUILDINGS



Example #1- A single story detached garage only, no fixed stairs to attic storage or no storage above, can use the overhead door as the sole means of egress.

Example #2- A detached garage with fixed set of stairs to a non-habitable space (bathrooms, toilet rooms, closets, halls, storage or utility spaces) must have a compliant door per section R302.5.1. The stairs can be open to garage with no separation required.

Example #3- A detached garage with a fixed set of stairs to a habitable space (living, sleeping, eating or cooking) above must have a compliant egress door per section R311.2 and separation requirements as listed in section R302.5.1. This could be accomplished by stair chase with drywall separating stairs/egress door from garage or an exterior flight of stairs off upper level. For dwelling units constructed prior to the 2012NCRC see table 302.6 footnote a.

ACCESSORY STRUCTURES

R101.2.2 Accessory structures. The following *accessory structures* shall meet the provisions of this code.

1. Decks, see Appendix M.
2. Gazebos.
3. Retaining walls, see Section R404.4.
4. Detached masonry chimneys located less than 10 feet (3048 mm) from other buildings or lot lines.
5. Swimming pools and spas, see Appendix V.
6. Detached carports.
7. *Docks, piers, bulkheads*, and waterway structures, see Section R327.

Exception: Portable, lightweight carports not exceeding 400 square feet (37 m^2) or 12 feet (3658 mm) mean roof height.






PREFABRICATED ACCESSORY STRUCTURES

Prefabricated structures sold online and at stores that exceed the limitations under R101.2.1 will require a building permit.

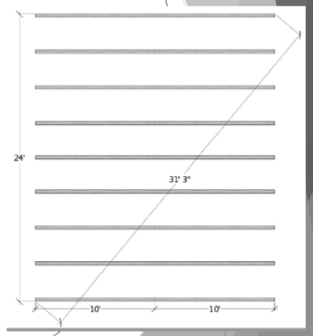
- A NC registered Engineer, Architect or 3rd Party Modular Home Inspector shall inspect and certify that the structural system meets all applicable standards of the NCRC or NCBC for the intended occupancy.

BUILDING PLANS PURCHASED ONLINE

- There are many websites selling building plans for large sheds or playhouses to be DIY'ed by homeowners.
- Some of this structures exceed The accessory building limitations (R101.2.1) and will be required to meet all applicable requirements per the NC Residential code.

BUILDING PLANS PURCHASED ONLINE

- The instructions on these plans typically indicate that the structure may be placed on skids or runners directly on the ground.
- This is not be allowed by the NCRC for structures exceeding the limits established under R101.2.1.
- These structures require a permanent foundation per code.



ACCESSORY BUILDING FOUNDATIONS

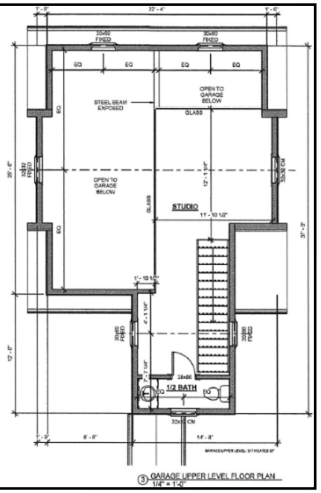
As a local interpretation, Mecklenburg County will allow the following foundation types on accessory buildings:

- Pressure-treated 4X4 posts, starting at one side of a structure and placed no more than 4 ft. O.C. spacing where the topography is flat.
- Where the topo is not flat, solid CMU blocks that are 4" X 8" X 16" stacked no more than 18 inches high and no more than 4 ft. apart under all 4 X 4's posts.

CONVERTING GARAGES INTO ADUs

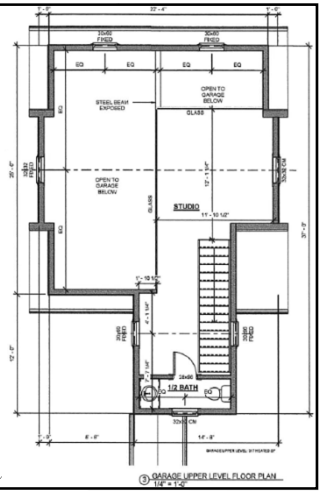
- At times a homeowner will submit a permit for a garage with storage space above and later on, turn the space above into an ADU.
- Although it is possible to retrofit a garage space into an ADU per the building code, it may not be possible per the zoning code.
- When we encounter these types of projects, our policy is to send a courtesy notification to the zoning department.

Do we need to provide protection between the garage below and the studio above?



Do we need to provide protection between the garage below and the studio above?

- NO.
- This garage is an accessory building placed away from the dwelling.
- Separation is only required between dwellings and garages.



NEW LOFT DEFINITIONS

LOFT. A floor level located more than 30 inches (762 mm) above the main floor and open to it on at least one side with a ceiling height of less than 6 feet 8 inches (2032 mm), used as a living or sleeping space.

Section R305
Ceiling Height

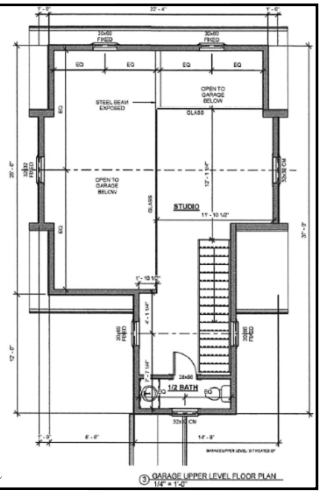
R305.1 Minimum height. *Habitable space*, hallways and portions of *basements* containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exceptions:

1. For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet (1524 mm) and not less than 50 percent of the required floor area shall have a ceiling height of not less than 7 feet (2134 mm).
2. The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a ceiling height of not less than 6 feet 8 inches (2032 mm) above an area of not less than 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.
3. Beams, girders, ducts or other obstructions in *habitable space* shall be permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor.
4. Ceiling heights in *lofts* are permitted to be less than 6 feet 8 inches.

NEW LOFT DEFINITIONS APPLIED TO ACCESSORY STRUCTURES

- Accessory buildings are not intended for living purposes. (NO WRB)
- Therefore the new LOFT provisions can not be used in an accessory buildings because the new definition states that they are to be used as a living or sleeping space.



Garages connected to the dwellings

TABLE R302.6 DWELLING-GARAGE SEPARATION

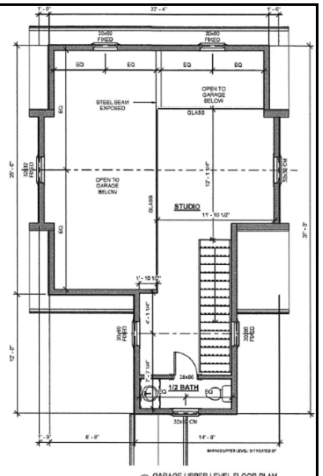
- Attached Garage: Separation per R302.6 is required
- Detached Garage: A 3'-0" min. fire separation distance is required.
- Semi-Detached Garage (connected by an open breezeway). The open air breezeway satisfies and exceeds the fire/smoke protection required in R302.6.

TABLE R302.6
DWELLING-GARAGE SEPARATION[a]

SEPARATION	MATERIAL
From the residence and attics	Not less than $\frac{1}{2}$-inch gypsum board or equivalent applied to the garage side
From habitable rooms above the garage[a]	Not less than $\frac{5}{8}$-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than $\frac{1}{2}$-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than $\frac{1}{2}$-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

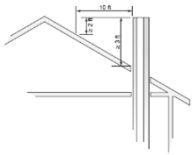
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. For dwelling units constructed prior to the 2012 North Carolina Residential Code edition, $\frac{5}{8}$-inch or greater existing gypsum board on the bottom side of the garage ceiling shall be acceptable. Joints shall be taped.



OUTDOOR FIREPLACES

- Chimney termination R1003.9.
- The requirements of this section shall apply as well to outdoor chimneys in proximity to ANY home.

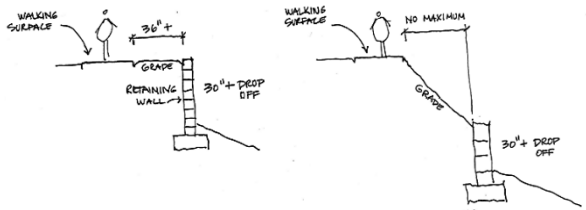


RETAINING WALLS

- *Per R404.1.3, the following residential retaining walls require design and are required to be permitted:*
  - *1. All retaining walls with an unbalanced condition exceeding 48 inches*
  - *2. All retaining walls that cross over property lines*
  - *3. All retaining walls that support buildings and their accessory structures*

RETAINING WALLS - GUARDS

When the finished area on the high side of the wall is more than 30 inches above the grade below and part of an egress route or other dedicated walking surface; guards are required.



IN-HOME DAYCARES

2018 NC Building Code

ADULT OR CHILD IN-HOME DAYCARES
ARE TYPICALLY REGULATED BY THE 2018 NC RESIDENTIAL CODE…

WITH SOME EXCEPTIONS.

ADULT OR CHILD IN-HOME DAYCARES (≤6 Able-bodied)

NCBC 428.2

- Section 310.5.1 of the NCBC states that R3 care facilities can be designed per the NCRC ONLY IF they have sprinklers.
- However, the most specific requirement takes precedence and NCBC 428.2 is a NC amendment that states that these facilities can be classified as single-family residences per the NC Residential Code.(no sprinklers are required).

310.5.1 Care facilities within a dwelling. Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the *International Residential Code* provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code*.

Exception: Respite care facilities shall be provided with an NFPA 13 sprinkler system complying with Section 903.3.1.1.

428.2 Residential care homes. Homes keeping no more than six adults or six unrestrained children who are able to respond and evacuate the facility without assistance, determined by the state agency having jurisdiction to be licensable, shall be classified as single-family residential (*North Carolina Residential Code*).

428.2.1 Means of egress. Each normally occupied story of the facility shall have two remotely located means of egress exits.

428.2.2 Smoke detection systems. Smoke detectors shall be provided on all levels per the *North Carolina Residential Code*.

428.2.3 Interior finishes. Interior wall and ceiling finishes shall be Class A, B or C.

428.2.4 Heating appliances. Untented fuel-fired heaters and portable electric heaters shall be prohibited.

SMALL ADULT OR CHILD IN-HOME DAYCARES

NCBC 428.3

- Other types of care facilities may also be regulated under the NCRC.
- Section 428.3 states that other types of small licensed facilities may stay within the NC Residential Code, provided they comply with additional conditions.

428.3 Licensed small residential care facilities. The following facilities when determined by the State Agency having jurisdiction to be licensable, shall be classified as single-family residential.

1. Residential care facilities keeping no more than six adults or six unrestrained children with no more than three who are unable to respond and evacuate without assistance.
2. Residential care facilities keeping no more than five adults or five children who are unable to respond and evacuate without assistance, when certifiable for Medicaid reimbursement, and when staffed 24-hours per day with at least two staff awake at all times.
3. Residential care facilities keeping no more than nine adults or nine children who are able to respond and evacuate without assistance.

ADULT OR CHILD IN-HOME DAYCARES CONDITIONS

NCBC 428.3

Section 428.3 states that other types of small licensed facilities can stay within the NC Residential Code, provided they comply with additional requirements.

- Construction Type
- Building Height & Area
- Exits
- Egress Stairs
- Smoke and Heat Detectors
- Incidental occupancy protection
- Fire alarm
- Non-combustible finishes
- Limited heat appliances
- Ground level and adult supervision for children under 6.

428.3.1 Construction type. The building shall be of 1 hour fire-resistant construction including all walls, partitions, floors and ceilings and bedroom doors shall be 1⅜ inches (34 mm) solid wood core.

Exception: No rating shall be required if the building is NFPA 13D sprinklered with a wet pipe system with a 30-minute water supply. Bathrooms, toilets, closets, pantries, storage and utility spaces shall be sprinklered. The sprinkler system shall be monitored in accordance with Section 903.4 (Section 903.4, Exception 1 is not applicable in this occupancy).

428.3.2 Building height and area. Buildings shall not exceed two stories in height or the area limitations for Group R-4. For purposes of this section, attics and basements used as habitable spaces shall be counted as stories.

428.3.3 Quantity of exits. Each normally occupied story of the facility shall have two remotely located exits.

428.3.4 Egress stairs. Required facility egress stairways shall be either exterior unenclosed or interior enclosed on each level with 1-hour fire barriers and self-closing 20-minute labeled doors. Other interior stairways shall be enclosed on one floor level with 1-hour fire-resistant walls and self-closing 20-minute labeled doors.

428.3.5 Smoke and heat detectors. Smoke detectors shall be provided on all levels in accordance with the *North Carolina Residential Code*. Heat detectors shall be installed in all attic spaces. The heat detectors shall be connected to the fire alarm and detection system.

428.3.6 Incidental accessory occupancies. Any incidental use area (as defined by Table 509) shall be enclosed with 1-hour fire barriers and self-closing 20-minute labeled doors or provided with an automatic sprinkler system and smoke-resistant separation from other areas.

428.3.7 Fire alarm systems. A building fire alarm system shall be provided in accordance with NFPA 72. Provisions shall be made to activate the internal evacuation alarm at all required exits.

428.3.8 Interior finishes. Interior wall and ceiling membranes shall be gypsum wallboard, plaster or other noncombustible material.

428.3.9 Heating appliances. Unvented fuel-fired heaters, floor furnaces, and portable electric heaters shall not be installed.

428.3.10 Occupants. Occupants younger than six-years of age shall sleep on the level of exit discharge with adult supervision.

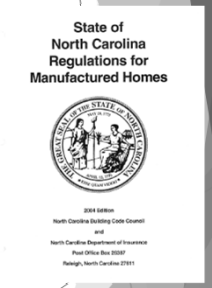
MANUFACTURED HOMES

2018 NC Building Code

CODE DEVELOPMENT OF MANUFACTURED HOMES

NC REGULATIONS FOR MANUFACTURED HOMES

- In 1969 NC enacted a law requiring mobile homes offered for sale in NC to comply with the Standard for Mobiles Homes: USAS A119.1.
- In 1971 the state started requiring them to have an approved label of compliance.
- In 1974 the US Congress decided that creating standards and regulations by HUD (Dept. Housing and Urban Development) was necessary to reduce mobile home accidents



CONSTRUCTION VS. INSTALLATION

- In 1976 HUD implemented: *Part 3280 Manufactured Home Construction and Safety Standards*. This standard preempted the states form regulating mobile home construction.
- However, the states retained jurisdiction over how mobile homes are installed. This is what NCRMH does.

MOBILE VS. MANUFACTURED

1976

- In 1982 HUD officially changed the mane "mobile home" to "manufactured home".
- From a technical standpoint, the term 'mobile home' is only appropriate for unregulated structures built before regulations were enacted in July 15, 1976. We also call these home Pre-HUD homes.
- If the home was built after July 15, 1976, the correct term should be 'manufactured home'.

HUD CODE

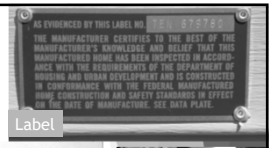
24 CFR Part 3280 Manufactured Home Construction & Safety Standards

- Today's manufactured homes are built according to very stringent HUD standards. They functional, durable and sometimes indistinguishable from site-built homes.
- This standard regulates:
  - The design and construction
  - Strength and durability
  - Transportability
  - Fire resistance
  - Energy efficiency
  - Overall quality
  - Performance standards for all house systems, including electrical, plumbing, heating and air conditioning

How to identify a factory-built home?

http://www.ncdoi.com/OSFM/Manufactured_Building/documents/Memos_Modular/How%20to%20Identify%20a%20Factory%20Built%20Home%20-%20All%20Types_.pdf

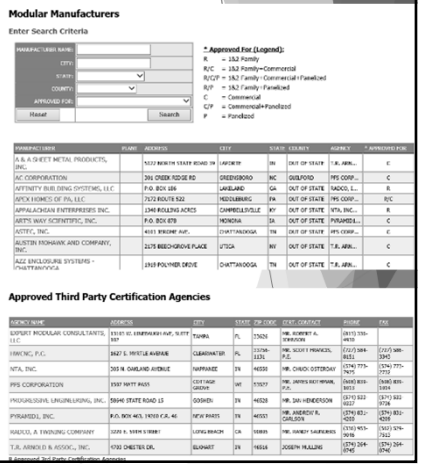
- Labels
- Data Plates
- Serial Numbers
- 3rd Party Labels
- Data Plate
- NC Validation Stamp (Pre-HUD: 07/01/70 to 06/15/76)



APPROVED MANUFACTURERS

http://www.ncdoi.com/OSFM/Manufactured_Building/apps/Modular_Manufacturers_Search.aspx?user=General_Public

- There are 108 NC State approved manufacturers on the NCDOI website.
- There are 8 NC State approved 3rd party certification agencies on the NCDOI website. (They've approved more).



Manufactured Home Additions and/or Conversions to a Commercial Use

http://www.ncdoi.com/OSFM/Manufactured_Building/Documents/Memos_Manufacturer/Conversion%20of%20Manufactured%20Home%20to%20Other%20Occupancy%20(revised%202-21-11)_.pdf

- A NC registered Engineer, Architect or 3rd Party Modular Home Inspector shall inspect and certify that the structural, plumbing, mechanical and electrical systems meet all applicable standards of the NCRC or NCBC for the intended occupancy.
- The design professional shall submit a list indicating the items that comply with code, the items that don't comply with code and the corrective measures required for code compliance. The list shall include foundations and accessibility requirements if applicable.

Manufactured Home Additions and/or Conversions to a Commercial Use

http://www.ncdoi.com/OSFM/Manufactured_Building/Documents/Memos_Manufacturer/Conversion%20of%20Manufactured%20Home%20to%20Other%20Occupancy%20(revised%202-21-11)_.pdf

- When the corrective measures are complete, they shall be inspected by the AHJ OR by the design professional. Documentation shall be submitted to the code official certifying that design professional has inspected the work and that it meets the applicable codes.

FEMA – Manufactured Housing Units (MHUs)

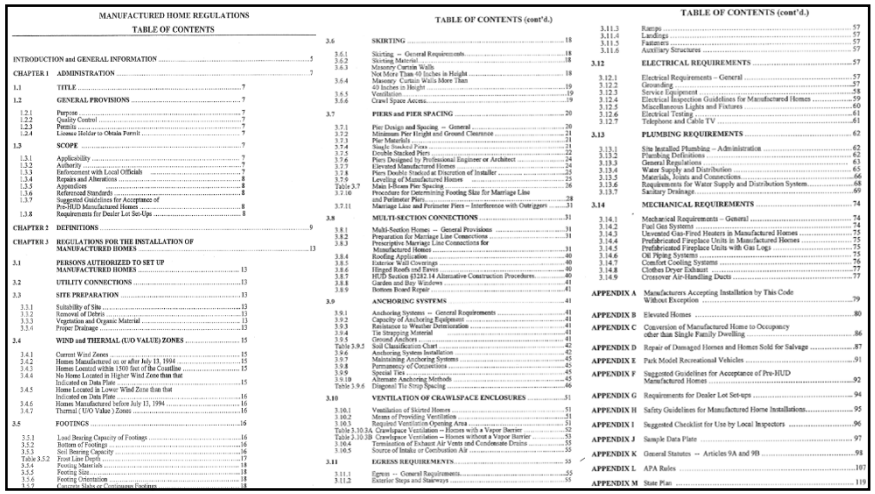
- These units are owned by the Federal Government (FEMA) and are installed, maintained and serviced by a Contracting Officer's Representative (COR).
- These units may be in place for up to 18 months during the recovery period.
- Installation permits are typically required.

Elevated Homes

http://www.ncdoi.com/OSFM/Manufactured_Building/Documents/Memos_Manufacturer/Elevated%20Homes%20-%20PE%20seals%20(revised)_.pdf

Section 3.7.7 of the North Carolina Regulations for Manufactured Homes, 2004 Edition states:

- When more than 1/4 of the home is more than 3' above ground level, the home stabilizing system shall be designed and sealed by a qualified Professional Engineer or Architect.
- However…NCDOI will allow elevated homes designs to be installed without a seal, if the elevated setup is detailed in the manufacturer's installation instructions.
-



MANUFACTURED HOME REGULATIONS

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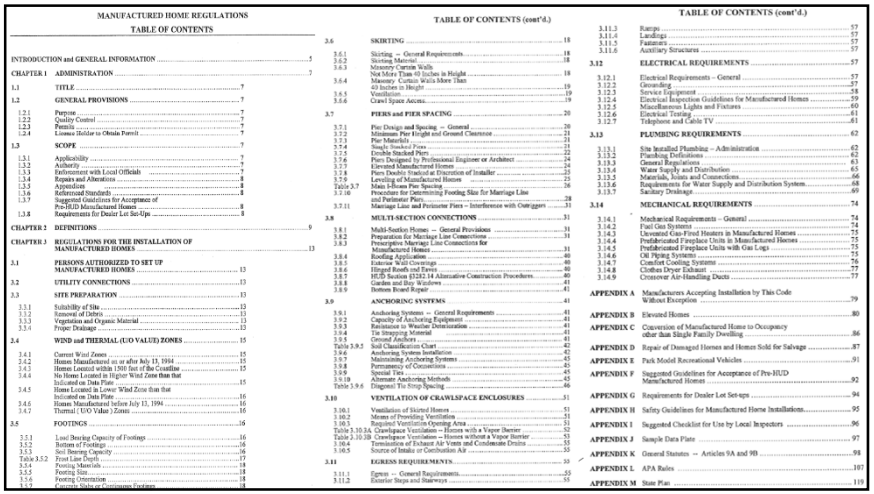

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RECYCLED CONTAINER UNITS

CONTAINER HOUSING:
Must comply with the Manufactured Housing Standards or the NCRC. They often are 3rd party listed and inspected. Installation may be conducted by the AHJ or an approved 3rd party agency.

TEMPORARY STRUCTURES:
Recycled container units are also used as temporary structures erected for a period of less than 180 days. Typically used for on-demand for retail or food service. They should follow the NCBC or be 3rd party listed and inspected.

TEMPORARY HEALTH CARE STRUCTURES

REQUIREMENTS:

- A transportable residential structure, providing an environment facilitating a caregiver's provision of care for a mentally or physically impaired person.
- Must be constructed under the NC Modular Construction Program.
- The unit is limited to one occupant which shall be the mentally or physically impaired person. The maximum area allowed is 300sf.
- The temporary family health care Structure must be removed within 60 days in which the impaired person is no longer receiving care or is no longer in need of care. For this reason it shall not be installed on a permanent foundation.

TINY HOMES ON WHEELS (THOW)

DEFINITION:
Tiny homes on a chassis, axle(s) and wheels that are <400 SF.
They may be custom or factory fabricated.

REQUIREMENTS:

- Building code requirements are not applicable. The chassis must remain connected.
- HUD prohibits the sale and lease of homes that do not meet federal standards, this may only be sold as a vehicle with a VIN number.
- They cannot have any permanent electrical, plumbing or mechanical connections. It may only connect to an external electrical supply system that is regulated by the State Electrical Code by an accessible cord-and-plug.

TINY HOME WITH A PERMANENT FOUNDATION

DEFINITION:
Tiny homes designed and sold for recreational or full-time use on a permanent foundation and/or that are over 400 SF are considered single family dwellings.

REQUIREMENTS:

- Regulated by the 2018 NC Residential Building Code.
- Compliance though the HUD Manufactured Housing Construction Program or the NC Modular Construction Program can be accepted instead of the 2018 NCRC.
- A permanently fixed foundation per the NCRC is required, with the complete removal of the trailer tires.
- ICC 2018 Appendix Q may be used as an alternate means and methods to address ceiling heights, sleeping lofts, loft access and emergency egress and rescue.

RVs & TINY HOME RVs

DEFINITION:
Vehicles built on a single chassis, 400 SF or less when measured at their largest horizontal projections, self-propelled or permanently towable by a light duty truck. They are designed as temporary living quarters for recreational, camping, travel, or seasonal use

REQUIREMENTS:

- Not regulated by the building code.
- Require certification per NFPA 1192-15 standard for RVs or the ANSI A119.5-15 standard for park models.
- Cannot be accepted as a permanent dwelling structure in NC unless it has a dual label by HUD Manufactured Housing Construction Program or the NC Modular Construction Program label.
- Cannot have any permanent electrical, plumbing or mechanical connections. It can only physically connect to an external electrical supply system that is regulated by the State Electrical Code by an accessible cord-and-plug.
- The wheels and axles must remain on the unit at all times.

Park Model RVs & Park Trailer RVs

DEFINITION:
A recreational vehicle designed only for recreational use only. A unit that is built on a single chassis mounted on wheels and has a gross trailer area not exceeding 400 SF in the set-up mode.
Park model RVs can be housed on private rural property in most states, as well as on most RV campgrounds and in resorts around the country because they are labeled as RVs.

REQUIREMENTS:

- Not regulated by the building code.
- Requires certification per ANSI A119.5-15 standard for park models.
- Cannot have any permanent electrical, plumbing or mechanical connections. It can only physically connect to an external electrical supply system that is regulated by the State Electrical Code by an accessible cord-and-plug.
- The wheels and axles must remain on the unit at all times.
- Cannot be accepted as a permanent dwelling structure in NC unless it has a dual label per the HUD Manufactured Housing Construction Program or the NC Modular Construction Program label.

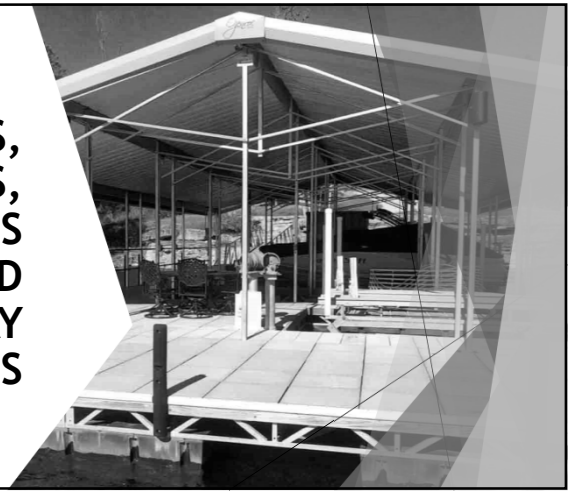
Bus, Truck or Van Conversions

DEFINITION:
Converted motorized vehicles. Unlabeled and/or site constructed recreational park trailers greater than 400 SF gross trailer area will be considered to be a non-complying single-family dwelling in violation of the NC Residential Code.

REQUIREMENTS:

- Unlabeled and/or site-constructed units cannot be accepted as a permanent dwelling structure in NC.
- Motorized vehicles are exempt from NCRC and HUD jurisdiction.
- The wheels and axles must remain on the unit at all times.
- When a recreational vehicle becomes a permanent structure, it must be permitted, inspected, and comply with all the State Building Codes or the NC Manufactured Building Division.

DOCKS, PIERS, BULKHEADS AND WATERWAY STRUCTURES



DOCKS, PIERS, BULKHEADS AND WATERWAY STRUCTURES

NCRC R327

Summary…

Most docks, piers, bulkheads and waterway structures are exempt from the provisions of the residential code.

DOCKS, PIERS, BULKHEADS AND WATERWAY STRUCTURES

NCRC R327

The following structures do not have to meet the code provisions.

1. Fixed piers associated with a one- or two-family dwelling meeting all of the following:

- 4 boat slips maximum.
- 15’ maximum height.
- 13’ maximum normal pool depth in lakes & ponds & 7’ feet mean low water depth in other locations.
- 6’ maximum walkway width.
- 8’ maximum pile spacing.
- 576 sf maximum non-walkways areas.
- 40 ft. maximum boat slip length.
- 576 SF maximum roofed area plus 2 FT maximum overhang.
- No enclosed or multilevel structures
- 16,000 pounds maximum boat lift capacity.

FIXED PIERS

NCRC R327

Fixed piers associated with a one- or two-family dwelling do not have to meet code when they meet all of the following:

- 4 boat slips maximum for a single owner or two adjacent riparian owners.
- 15’ maximum height.
- 13’ maximum normal pool depth in lakes & ponds & 7’ feet mean low water depth in other locations.
- 6’ maximum walkway width.
- 8’ maximum pile spacing.
- 576 sf maximum non-walkways areas.
- 40 ft. maximum boat slip length.
- 576 SF maximum roofed area plus 2 FT maximum overhang.
- No enclosed or multilevel structures.
- 16,000 pounds maximum boat lift capacity.

FLOATING DOCKS

NCRC R327

Floating docks associated with a one- or two-family dwelling do not have to meet code when they meet all of the following:

- 4 boat slips maximum for a single owner or two adjacent riparian owners.
- 20’ maximum normal pool depth in lakes & ponds & 10’ feet mean low water depth in other locations.
- Finger piers, crosswalks or other floating surfaces having a minimum width of 3 ft. wide to a maximum of 6 ft., except for a single 8-foot by 16 ft. section.
- When constructed with a roof and meets the conditions listed under section 2.5.
- No enclosed or multilevel structures.
- 16,000 pounds maximum boat lift capacity.

DUPLEX HOMES

2018 NC Building Code

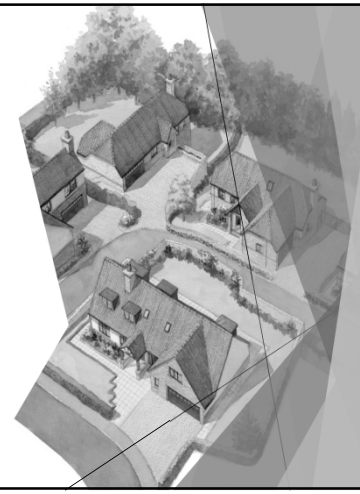
HOW MANY HOUSES CAN I HAVE ON ONE LOT ?

- The intent of the NC Residential Code is to have up to two dwellings on a lot.

  Examples:
  - One single-family home + and accessory dwelling unit (ADU).
  - One duplex building.

- There is no limit on the number of townhome units in the NCRC.

- When a project exceeds two units per lot, we will consider it a commercial project that is regulated by the NC Building Code.
- The terms “R3” and “Single-family home” <u>are NOT interchangeable</u>.
- R3s are homes designed per the commercial code.



- Zoning regulations in our area will also prohibit two full sized homes on a lot.
- They would only allow one primary home and one smaller accessory dwelling unit.

CAN I TURN MY DUPLEX INTO A TOWNHOUSE?

…or vice versa.

CAN I TURN MY DUPLEX INTO A TOWNHOUSE? or vice versa

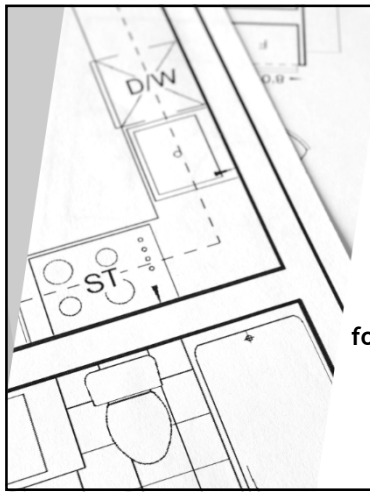
- Not technically because the 2018 NCRC defines a townhome as a building with three or more units.
- A duplex with a property line in between units is currently considered by code, a building with a zero lot line.

[RB] TOWNHOUSE. A single-family *dwelling unit* constructed in a group of three or more attached units separated by property lines in which each unit extends from foundation to roof and with a *yard* or public way on not less than two sides.

CAN I TURN MY DUPLEX INTO A TOWNHOUSE? or vice versa

- Turning a townhome into a duplex is more challenging in terms of electrical service. Because a duplex is considered a single building it can only have one point of service.

[RB] TOWNHOUSE. A single-family *dwelling unit* constructed in a group of three or more attached units separated by property lines in which each unit extends from foundation to roof and with a *yard* or public way on not less than two sides.



December 2019

UNDERSTANDING CONSTRUCTION DRAWINGS

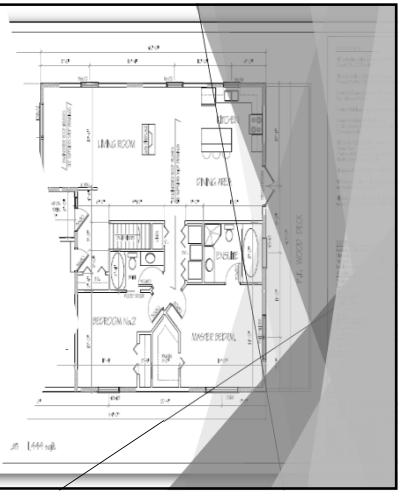
for new residential or commercial building CEOs

CONSTRUCTION DOCUMENTS: Basic Concepts

WHY DO WE NEED CONSTRUCTION DRAWINGS?

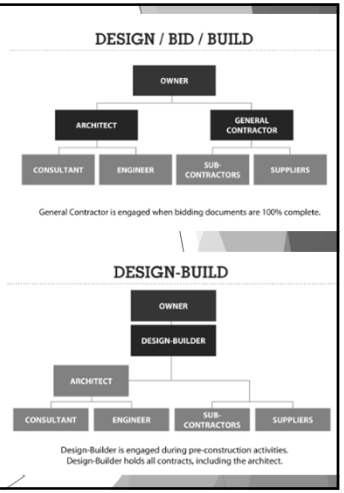
Construction Drawings are necessary to:

- Define the scope and complete the project in a timely manner.
- Make contractual agreements.
- Estimate costs for materials and labor.
- Obtain permits.
- Define a construction schedule.



WHO DRAWS & COORDINATES CONSTRUCTION DRAWINGS?

- The Design Professional <u>in responsible charge</u>
- Person responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittals items.
- Typically, the Architect or Design-Builder.
- There can only be <u>ONE</u>.



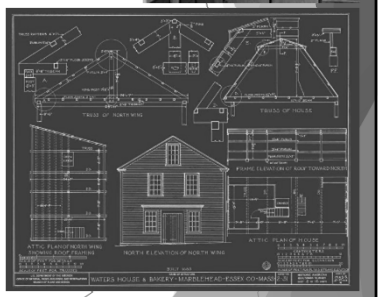
WHO SIGNS AND SEALS THE DRAWINGS?

The Design Professional of Record.

- There will be a design professional of record for each discipline.
- As a general rule, the Architect should ONLY stamp the drawings he was in charge of the preparation of and under his/her supervision and direct control. The Engineers shall stamp his/her documents.
- *Dual stamps could be allowed if accompanied by a clarifying note describing the responsibilities.*

WHY DO WE CALL CONSTRUCTION DOCUMENTS BLUEPRINTS?

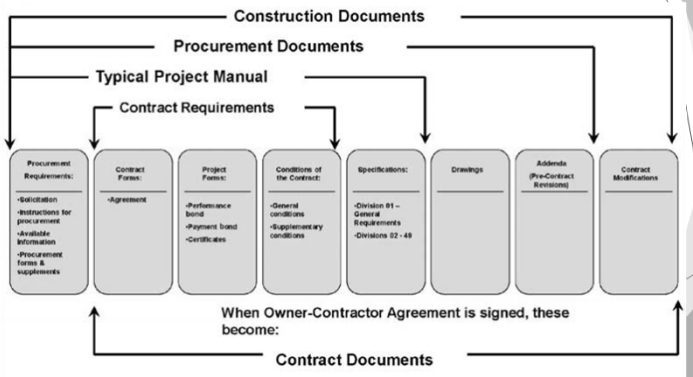
- This is because one of the first processes developed to duplicate drawings, produced white lines on a blue background; hence the term blueprint.
- We still use the term blueprint to describe copies of original drawings or tracings.



WHAT ARE CDs?

- CDs is an abbreviation for **Construction Documents**, which often consist of a set of many other documents and drawings, such as:
  - Construction Drawings.
  - Building specifications.
  - Special instructions.
  - Code and zoning requirements.
  - Design team and vendor information.
  - Liability limits.
  - The cost estimate of the building.

CONTRACT VS. CONSTRUCTION DOCUMENTS



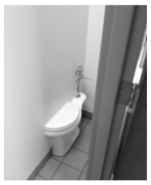
WHY IS IT IMPORTANT TO INTERPRET PLANS CORRECTLY?

- Learning how to interpret construction plans is an essential skill for anyone in the construction industry.
- Construction drawings vary from simple to very complex, so understanding how to read AND interpret the drawings is crucial for understanding the project's scope quickly and accurately.

WHAT COULD POSSIBLY GO WRONG?








TYPES OF DRAWINGS

- The meanings of different types of drawings can be confusing and misapplied.
- It is important to know the difference to reduce liability.

CAD DRAWINGS

- Computer-aided design (CAD) is a process that allows people draw on-screen, rather than by hand.
- Though CAD drawings have been in use since the 1960s, it wasn't until the early 1990s that CAD software became a cost-effective option.
- CAD software changed the industry because it allowed architects and engineers to draw their own designs, rather than to attempt to explain them to a draftsperson.


BUILDING INFORMATION MODELING (BIM DRAWINGS)

- Drawings generated from three dimensional building models.
- Complex projects, use 3D models for architectural, structural, mechanical and electrical.

BUILDING INFORMATION MODELING (BIM DRAWINGS)

- By modeling all the elements, hundreds of crashes between beams, columns, ducts, pipes and the many other features in a building can be identified during design, and be resolved in the office rather than in the field. BIM projects have minimal RFIs or Change Orders.
- The downside is that they are very time consuming and the quality of the details is usually poor.

AS-CONSTRUCTED RECORD DRAWINGS (a.k.a. AS-BUILTS)

- The changes that the contractor makes onto the original design are called as-built drawings.
- The as-built changes are made by the contractor in red ink.
- They are prepared by the contractor as required by contract.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the *use of the* Owner *and of the Architect* one copy of the Drawings, Specifications, Addenda, Change Orders, *field orders, approved Shop Drawings, Architect's Supplementary Instructions, requests for information and other Contract-related documents* and Modifications, *if any,* in good order and marked currently and *promptly by the Contractor* to indicate *all approved* field changes and selections made during construction. *The Contractor shall also maintain on site all available catalog data, price lists, manufacturers' operating and maintenance instructions, schematics, certificates, warranties, and guarantees.* The shall be available to the *Owner and the* Architect and shall be delivered to the Architect for submittal to the Owner upon *substantial* completion of the Work as a record of the Work as constructed.

RECORD DRAWINGS

- Drawings typically prepared by the architect, showing the building and equipment as installed by the contractor by the date of completion. It is an additional service.
- Because the information is provided by the contractor, the architect has no obligation to verify if the record drawings represent the built work.
- The as-built drawings are used for reference.

RECORD DRAWINGS

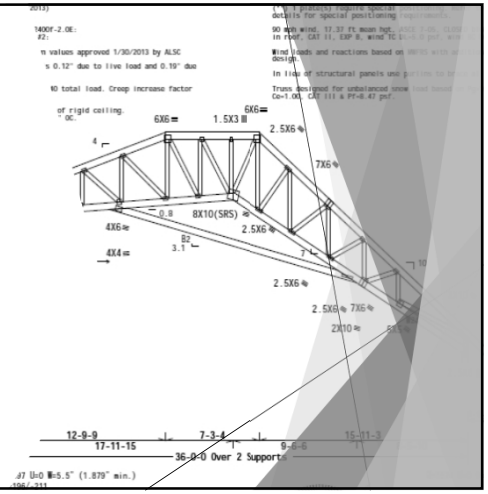
- They should be the same size as the original construction drawings.
- All access points for operating and maintenance purposes should be noted.
- They are typically not dimensioned, unless the dimension is necessary for location or maintenance.
- They are often used in conjunction with a building commissioning report.

MEASURED DRAWINGS

- Drawings prepared during the renovation or documentation of an already existing building.
- Although laser measuring tools are often used and incredibly accurate. The overall building dimensions and wall angles can be inexact.

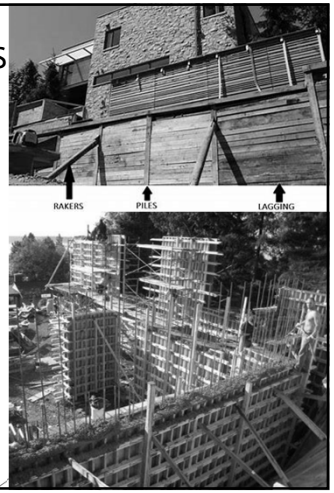
SHOP DRAWINGS

- Drawings and instructions provided by the manufacturer to assure all parts of a system are installed properly.
- They provide all the information necessary for installation; icluding the approximate weight of heavy pieces, the number of pieces, and other helpful data.



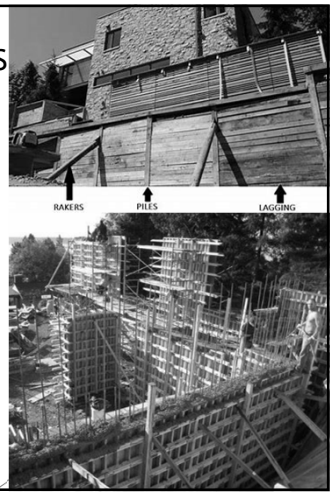
FALSEWORK VS. FORMWORK DRAWINGS

- Falsework or shoring is the temporary construction used to support vertical loads for a structure until it becomes self-supporting.
- Formwork is the temporary construction used to support freshly placed concrete.



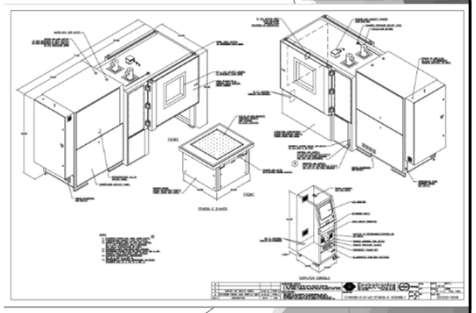
FALSEWORK VS. FORMWORK DRAWINGS

- For simple jobs, field sketches may be all that is needed. For elaborate jobs, drawings similar to the general drawings, details and specifications are necessary
- **ACI SP-4: Formwork for Concrete is an applicable standard.**
- Also remember that scaffolding is not shoring and shoring is not scaffolding. each system requires proper fall protection, access, and strength.



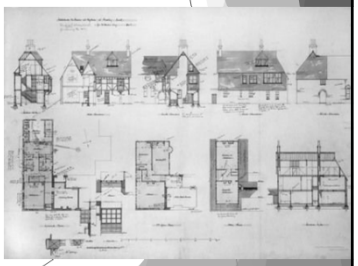
ASSEMBLY DRAWINGS

- Drawings used to show how to assemble parts of a kit.
- They show for example, how equipment is put together.
- They are out of the inspector's scope of work.



CONCEPT DRAWINGS

- Drawings or sketches used by designers to quickly explore design ideas.
- They can be freehand, or 3D modeled.
- They are not intended to be accurate and should not be used for construction.



ADDENDUM VS. AMENDMENT DRAWINGS

- Addendum is a formal notification of a change in the project before the bid is complete.
- Amendments or Bulletins are a formal notification of a change in the project after the bid is complete.

ADDENDUM VS. AMENDMENT DRAWINGS

- Revisions should only include the sheets that have changed. Some sheets may be re-issued several times during the project.
- A good practice is to insert the new sheet, just in front of the sheet being updated or changed. Then fold back the lower corner of the older sheet, tape it on the back and mark it as VOID next to the sheet number. This ensures the user has the current sheet and allows for quick reference to previous versions for comparison.

THE LANGUAGE OF CONSTRUCTION

These are other terms or acronyms you may come across in construction documents. These designations are typically irrelevant for the code official. The design must meet code:

Alternate bid items. They are portions of work shown on the architect's drawings, but not necessarily in the builder's contract to construct, supply, or install. Alternate bid items shouldn't be accepted during plan review without supervisor authorization.

"N.I.C." is an abbreviation for Not In Contract. It means a certain item will be put in a certain place by the owner after the project is finished.

"O.F.C.I." or "G.F.C.I." (Owner Furnished, Contractor Installed, or Government Furnished, Contractor Installed). They indicate the item is supplied by the customer, but installed by the contractor. This designation is irrelevant for the code official. The item must meet code.

THE LANGUAGE OF CONSTRUCTION

ASI: Architects Supplemental Instruction (no cost, no additional time)

PR: Proposal Request (cost)

CCD: Construction Change Directive (ASAP)

CO: Change Order (official agreement)

RFI: request for information (clarification)

PC or PCO: proposed change or proposed change order. (by the GC)

CDN: construction deficiency notice. (withholding payment)

HANDLING PLANS

- Plans are EXPENSIVE! Please handle with care.

YouTube: How to fold a D Size drawing to 8.5 x 11 inches for use in a binder

CONSTRUCTION DRAWINGS: Basic Concepts

BASIC GUIDELINES FOR READING CONSTRUCTION DOCUMENTS

- 1st step in becoming familiar with any plan should be to mentally walk through the building.
- 2nd step, is to walk through it again as if you are building it. (Civil, Structural, Architectural, MEP…)

BASIC GUIDELINES FOR READING CONSTRUCTION DOCUMENTS

- Start with the cover sheet. It contains important project information like the project name, architect, contact information, project information and the date. It might also include a drawing of the finished product.

BASIC GUIDELINES FOR READING CONSTRUCTION DOCUMENTS

- Be organized when reading plans. Start at the top left corner and work your way across page.
- Read each note as it is encountered, will help you understanding the project better.
- Look for other references that may be unique to the project.

RESIDENTIAL PLANS

THE MINIMUM REQUIREMENTS FOR RESIDENTIAL PLANS ARE:

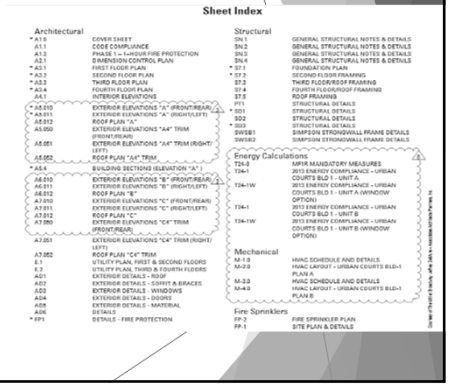
- Drawings to scale (minimum 1/8")
- Sheet minimum size 11”x17”
- Building designer information or responsible party including: name, phone number and address.
- Minimum font size of 10.

PLUMBING, MECHANICAL AND ELECTRICAL SHEETS

- Plumbing, mechanical and electrical plans are usually needed for larger commercial projects.
- Each individual discipline can be shown on separate sheets without making the Architectural Plan too crowded and difficult to understand.

DRAWING ORGANIZATION

- Drawings must be systematically organized, so information can be found easily.
- Most architects opt to use CSI and NCS standards for drawing organization.



Sheet Index

Architectural

*	A1.0	COVER SHEET
	A1.1	CODE COMPLIANCE
	A1.2	PHASE 1 – 1-HOUR FIRE PROTECTION
	A2.1	DIMENSION CONTROL PLAN
*	A3.1	FIRST FLOOR PLAN
*	A3.2	SECOND FLOOR PLAN
*	A3.3	THIRD FLOOR PLAN
*	A3.4	FOURTH FLOOR PLAN
	A4.1	INTERIOR ELEVATIONS
*	A5.010	EXTERIOR ELEVATIONS "A" (FRONT/REAR)
*	A5.011	EXTERIOR ELEVATIONS "A" (RIGHT/LEFT)
	A5.012	ROOF PLAN "A"
	A5.050	EXTERIOR ELEVATIONS "A4" TRIM (FRONT/REAR)
	A5.051	EXTERIOR ELEVATIONS "A4" TRIM (RIGHT/LEFT)
	A5.052	ROOF PLAN "A4" TRIM
*	A5.4	BUILDING SECTIONS (ELEVATION "A")
	A6.010	EXTERIOR ELEVATIONS "B" (FRONT/REAR)
	A6.011	EXTERIOR ELEVATIONS "B" (RIGHT/LEFT)
	A6.012	ROOF PLAN "B"
	A7.010	EXTERIOR ELEVATIONS "C" (FRONT/REAR)
	A7.011	EXTERIOR ELEVATIONS "C" (RIGHT/LEFT)
	A7.012	ROOF PLAN "C"
	A7.050	EXTERIOR ELEVATIONS "C4" TRIM (FRONT/REAR)
	A7.051	EXTERIOR ELEVATIONS "C4" TRIM (RIGHT/LEFT)
	A7.052	ROOF PLAN "C4" TRIM
	E.1	UTILITY PLAN, FIRST & SECOND FLOORS
	E.2	UTILITY PLAN, THIRD & FOURTH FLOORS
	A01	EXTERIOR DETAILS - ROOF
	A02	EXTERIOR DETAILS - SOFFIT & BRACES
	A03	EXTERIOR DETAILS - WINDOWS
	A04	EXTERIOR DETAILS - DOORS
	A05	EXTERIOR DETAILS - MATERIAL
	A06	DETAILS
*	FP1	DETAILS - FIRE PROTECTION

Structural

	SN.1	GENERAL STRUCTURAL NOTES & DETAILS
	SN.2	GENERAL STRUCTURAL NOTES & DETAILS
	SN.3	GENERAL STRUCTURAL NOTES & DETAILS
	SN.4	GENERAL STRUCTURAL NOTES & DETAILS
*	S7.1	FOUNDATION PLAN
*	S7.2	SECOND FLOOR FRAMING
	S7.3	THIRD FLOOR/ROOF FRAMING
	S7.4	FOURTH FLOOR/ROOF FRAMING
	S7.5	ROOF FRAMING
	PT1	STRUCTURAL DETAILS
*	SD1	STRUCTURAL DETAILS
	SD2	STRUCTURAL DETAILS
*	SD3	STRUCTURAL DETAILS
	SWSB1	SIMPSON STRONGWALL FRAME DETAILS
	SWSB2	SIMPSON STRONGWALL FRAME DETAILS

Energy Calculations

T24-0	MFHR MANDATORY MEASURES
T24-1	2013 ENERGY COMPLIANCE - URBAN COURTS BLD 1 - UNIT A
T24-1W	2013 ENERGY COMPLIANCE - URBAN COURTS BLD 1 - UNIT A (WINDOW OPTION)
T24-1	2013 ENERGY COMPLIANCE - URBAN COURTS BLD 1 - UNIT B
T24-1W	2013 ENERGY COMPLIANCE - URBAN COURTS BLD 1 - UNIT B (WINDOW OPTION)

Mechanical

M-1.0	HVAC SCHEDULE AND DETAILS
M-2.0	HVAC LAYOUT - URBAN COURTS BLD-1 PLAN A
M-3.0	HVAC SCHEDULE AND DETAILS
M-4.0	HVAC LAYOUT - URBAN COURTS BLD-1 PLAN B

Fire Sprinklers

FP-2	FIRE SPRINKLER PLAN
FP-1	SITE PLAN & DETAILS

CONSTRUCTION SPECIFICATION INSTITUTE (CSI)

CSI is an organization that works with groups around the globe to create and maintain the standards that guide the construction industry's communication and documentation.

United States National Cad Standard (NCS)

NCS United States National CAD Standard® - V6
a product of the National Institute of Building Sciences buildingSMART alliance℠

- NCS standardizes drawing conventions.
- Construction plans are often composed of industry-specific symbols. Be sure you understand what those symbols represent by reviewing the legend for the drawing that you're working with.
- Also understand that some companies do not follow any standards and their symbols may mean something else.

Line widths
0.25 mm (thin); 0.35 mm (medium); 0.50 mm (wide); and 0.70 (extra wide).

Text size:
3/32" - 3/8" text: 0.25 mm
5/32" - 3/8" text: 0.35 mm
7/32" - 3/8" text: 0.50 mm
1/2" - 1" text: 0.70 mm

DISCIPLINE DESIGNATORS

- Discipline designator are used for individual trades.
- Sometimes sheets can contain information from two disciplines. Example "*AS-100" for Architectural/Structural*.
- Drawings with dual professional seals on the same sheet, need further clarification.

LEVEL 1 DISCIPLINE DESIGNATORS	
G	General
H	Hazardous Materials
V	Survey/Mapping
B	Geotechnical
C	Civil
L	Landscape
S	Structural
A	Architectural
I	Interiors
Q	Equipment
F	Fire Protection
P	Plumbing
D	Process
M	Mechanical
E	Electrical
W	Distributed Energy
T	Telecommunications
R	Resource
X	Other Disciplines
Z	Contractor/Shop Drawings
O	Operations

SHEET NUMBERS

- Sheets are numbered by discipline, type and sequence.
- It is OK to skip numbers, if the designer anticipates new sheet needs to be inserted.
- Example:
  A-110 First Floor Plan
  A-115 First Floor Reflected Ceiling Plan
  A-120 Second Floor Plan
  A-125 Second Floor RCP
  A-130 Third Floor Plan
  A-135 Third Floor RCP Plan
  A-150 Roof Plan

Discipline Designator | Sheet Type | Sequence Number

AD107

SHEET TYPE DESIGNATORS	
0	**General** (symbols legend, notes, etc.)
1	**Plans** (horizontal views and combination Plan & Profile)
2	**Elevations** and Profiles (vertical views)
3	**Sections** (sectional views, wall sections)
4	**Large-Scale Views** (Scaled up reproductions of plans, elevations, Δ or sections that are not details)
5	**Details**
6	**Schedules and Diagrams**
7	**User Defined** (for types that do not fall in other categories, including typical detail sheets)
8	**User Defined** (for types that do not fall in other categories)
9	**3D Representations** (isometrics, perspectives, photographs)

SHEET NUMBERS

- The various sheets in any set of plans will have a sheet designation, typically Civil Engineering sheets will be called C-1, C-2 etc.; Architectural sheets are A-1, A-2, etc.; Structural sheets are S-1, S-2 and so on for Mechanical, Plumbing and Electrical Sheets (M, P and E).

LEVEL 1 DISCIPLINE DESIGNATORS	
G	General
H	Hazardous Materials
V	Survey/Mapping
B	Geotechnical
C	Civil
L	Landscape
S	Structural
A	Architectural
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D	Process
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E	Electrical
W	Distributed Energy
T	Telecommunications
R	Resource
X	Other Disciplines
Z	Contractor/Shop Drawings
O	Operations

COVER PAGE

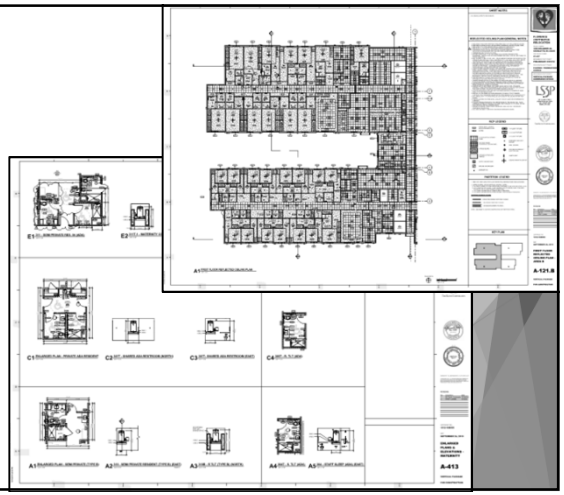
- This page usually contains a drawing of the actual project.
- It also includes the title block, revision block, notes, drawing scale and the legend.

TITTLE BLOCK

- Each sheet contains a “title block.”
- The shape, size, and placement of the title block can vary.
- Contains important information about the project and the company that created it. It contains the project’s name and number, the address, contact information, copyright information, revision dates, sheet number, issue date, scale and sheet number.
- If any of this basic information is missing, the design professional <u>should not sign it</u>.

GRIDS & DETAIL NUMBERS

- Some designers will incorporate the NCS grid into their drawings. <u>Use it!</u>
- It is extremely very useful for communicating. Helps finding things quicker.



DRAWING SCALES

- Construction plans are scaled down representations of the final project at a ratio of the actual size. For example, 1/8″ = 1′ (one eighth inch equals one foot).
- Never scale a drawing! If you cannot locate anything on the drawing with the dimensions given, get more dimensions from the Architect.
- Residential drawings are usually scaled at 1/48”

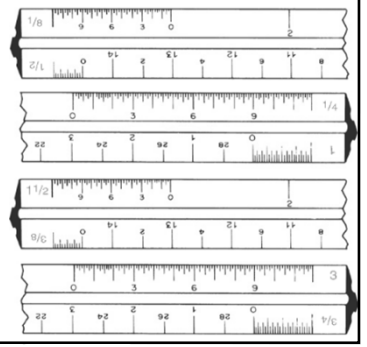
ENGINEERING VS ARCHITECTURAL SCALES

- Do not confuse architectural and engineering scales.
- Architect scales are in fractions and engineering scales are in decimals.

ARCHITECTURAL SCALES

- Triangular architect's scale includes 11 scales frequently used on drawings.
- Two scales are combined on each face.
- They should not be used in construction.

Full Scale	Full Scale
3/32"=1'-0"	3/16"=1'-0"
1/8"=1'-0"	1/4"=1'-0"
3/8"=1'-0"	3/4"=1'-0"
1/2"=1'-0"	1"=1'-0"
11/2"=1'-0"	3"=1'-0"



METRIC SCALES

FUN FACTS!

- The United States is the last industrialized country in the world to use the imperial or "inch-pound" system of measurement instead of the metric system, even though Congress adopted the metric system in 1975.
- Many government agencies that have a presence outside of the United States, such as the Dept. of Defense (DoD) will use metric scales. We may come across metric scales, when dealing with imported products or designs.
- There is distinction between a "hard" and "soft" conversions to the metric system.
  - A soft conversion is a direct mathematical conversion from a U.S. measurement to its metric equivalent e.g., from 180 pounds to 81.65 kilograms. Soft conversions are typically not recommended.
  - A hard conversion is the creation of a rounded, rationalized number that is easy to work with and easy to remember.

Example:

Imported guardrail with 100 mm max. spacing between rails.

Soft Conversion
4" = 101.6 mm

VS.

Hard Conversion
4" = 100 mm

SECTION 000: GENERAL

LINES
SYMBOLS
LEGENDS
NOTES

LINE ALPHABET

Drawings are the language of the construction industry.

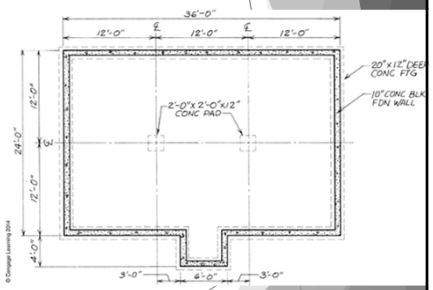
Basis of any language is the alphabet.

Construction drawings use an alphabet of lines.

Line weight or thickness varies to show relative importance and to help distinguish basic shape from surface details.

LINE ALPHABET

- Learn to recognize the different types of lines the architects and engineers may use.
- The plans should have a specific keynote table showing specific lines used in each section of the plans.
- Remember that a line used on the architectural plans may not mean the same on the electrical plans.



Object lines: Solid lines that show the edges and outlines of an object and where they intersect.

Hidden / Phantom Lines: Dashes that indicate edges, corners, and curved surfaces that are hidden behind the surface of the object.

Centerlines: Indicate and bisects the center point of an object. They usually have a "CL" symbol on one end.

Extension Lines: Thick, solid, parallel lines that extend out from an object.

Dimension Lines: Show the measurement of an object.

Cutting Plane Lines: Imaginary cut that shows a sectioned off internal part of an object that is not viewable from the outside.

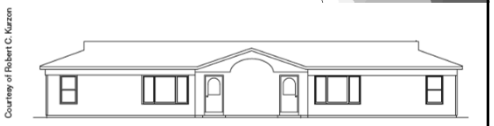
Break Lines: Look similar to graph lines and show if a part of an object was removed.

Leaders and Arrows: Comprising a solid line with a point at the end identify parts, locations and are the basis of welding symbols.

Phantom Lines: Series of dashes alternate position of moving parts or as a place holder for one to be added later.

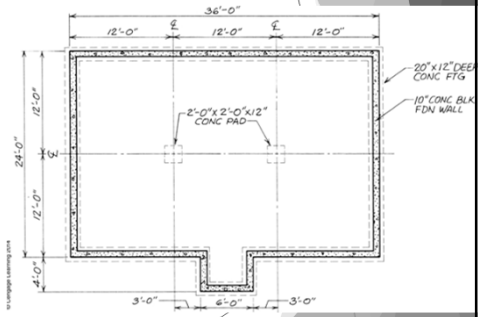
OBJECT LINES

- Object lines are solid.
- Used to show object shape.
- All visible edges are represented by object lines



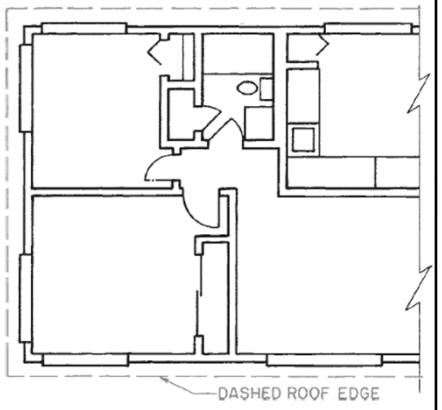
DASHED LINES

- Hidden lines show object edges that would not be visible
- Drawn as a series of evenly sized short dashes.
- Only used for most important features



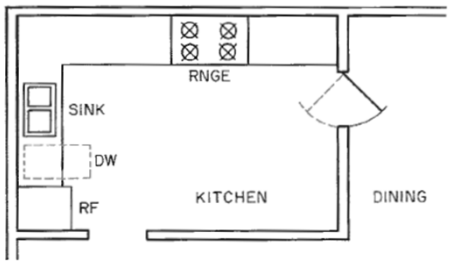
DASHED LINES

- Dash lines may also show important overhead construction.
- Not in hidden view, just not in view (e.g., beams on a ceiling).
- The dashed lines on this floor plan indicate the edge of the roof overhang.



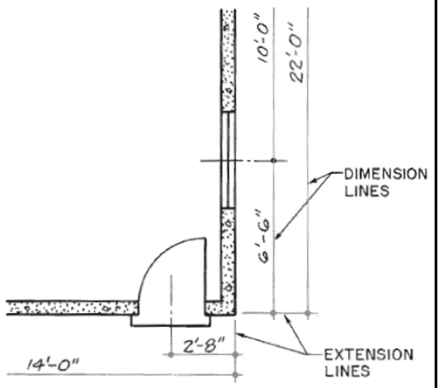
DASHED LINES

- Dash lines may also show important alternate positions.
- May be made up of different weights and lengths
- The dashed lines here are phantom lines to show alternate positions of the double-acting door and the door of the dishwasher



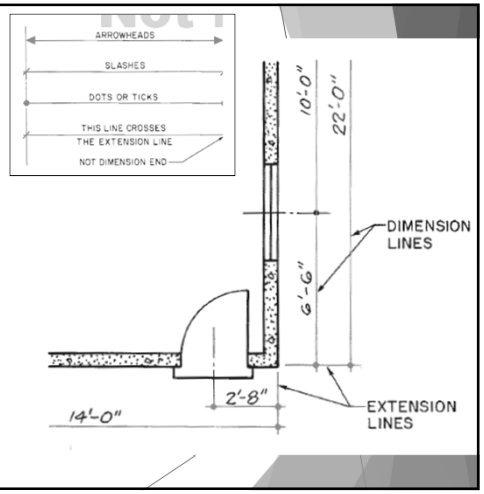
EXTENSION LINES

- Thin, solid lines that project from an object to show extent or limits of a dimension.
- Do not quite touch the object they indicate



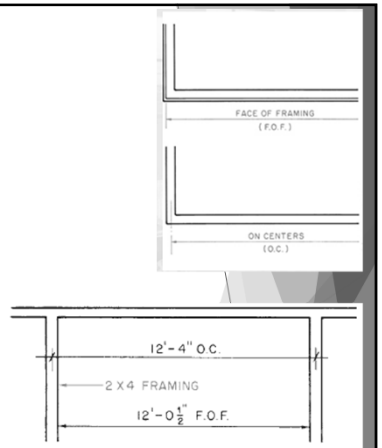
DIMENSION LINES

- Solid lines of the same weight as extension lines.
- Drawn from one extension line to the next.
- Dimension is lettered above the dimension line.
- Expressed in feet and inches.
- Chain dimensions are dimensions added together to come up with one overall dimension



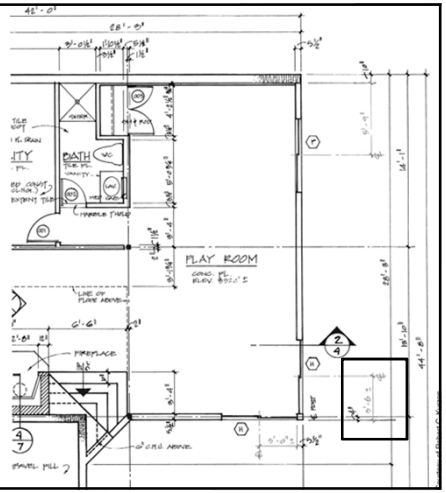
DIMENSION LINES

- Dimensions are given in a continuous string when practical.
- When walls are dimensioned to centerlines; One-half of the wall thickness must be subtracted to find the face of the studs



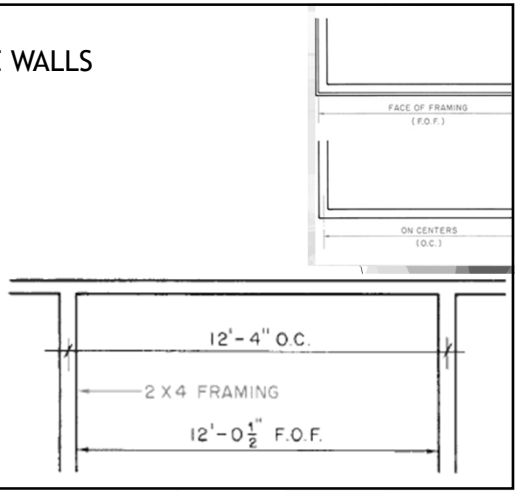
DIMENSION LINES

- Plus or minus (±) dimensions allows the builder to place openings on where most convenient.
- In this detail the intent is to place the sliders as close to the post as possible.



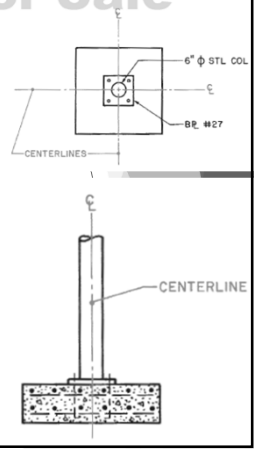
DIMENSIONING FRAME WALLS

- Exterior walls are usually dimensioned to the face of studs
- Interior walls may be dimensioned either to the face of studs or to their centerlines



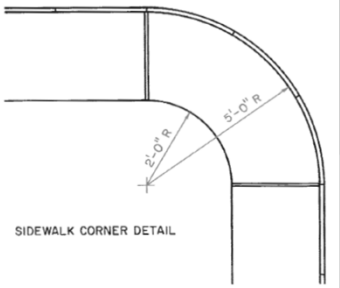
CENTER LINES

- Made up of long and short dashes.
- Show centers of round or cylindrical objects
  Indicate object is symmetrical.



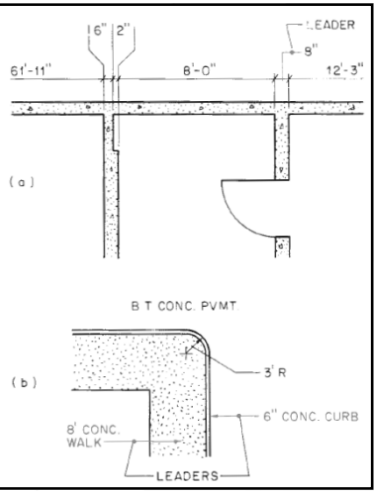
CENTER LINES

- Method of showing the radius of an arc.



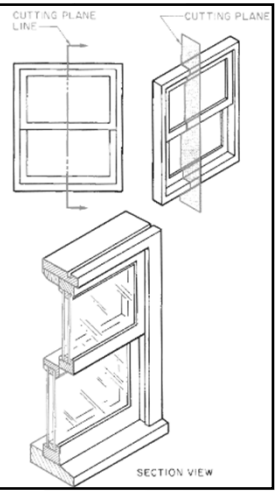
LEADERS

- Some construction details are too small for clear dimensioning.
- Dimension is shown in a clear area of the drawing.
- Leader is the thin line showing where the dimension belongs



CUTTING PLANE LINES

- Drawn on the view through which the cut was made.
- A cutting-plane line indicates where the imaginary cut is made and how it is viewed

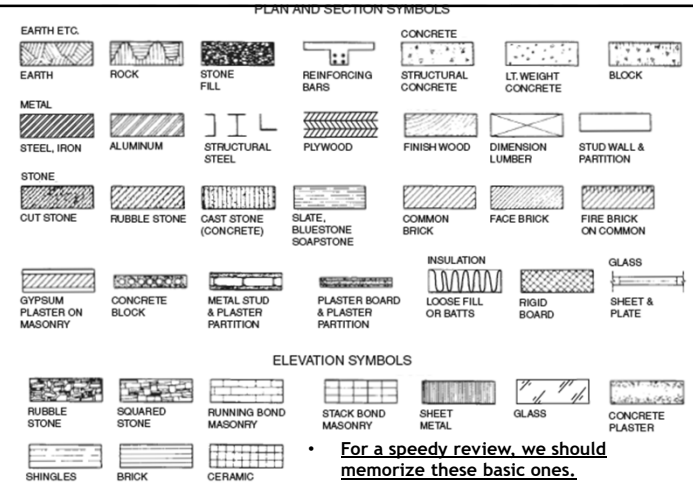


SYMBOLS

- Architects and Engineers use some basic graphics to describe specific building elements.
- These standardized graphics help the architect, engineer and builder communicate more clearly.

Examples:
- Masonry wall = 45-degree cross-hatching through the wall. Gypsum board = small dots between the two faces.
- Rigid insulation = small cross-hatched grid.
- Batt insulation = a continuous 'S' shape.

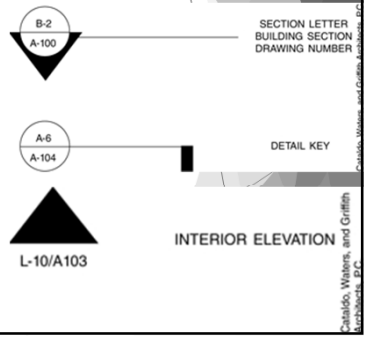
MATERIAL SYMBOLS



- **For a speedy review, we should memorize these basic ones.**

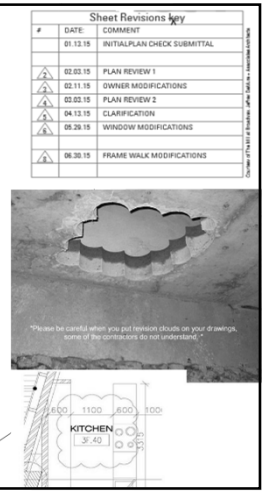
REFERENCE SYMBOLS

Section view symbols and detail drawings symbols are similar in appearance and format.



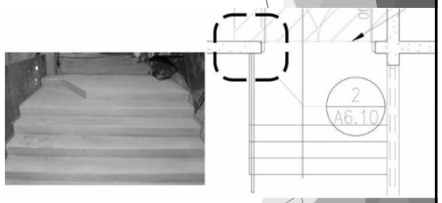
REVISION BLOCK & REVISION CLOUDS

- Any time there is change to a building, system, or component, the drawing must be redrafted.
- Those changes are listed in the Revision Block – usually with a date as well.
- Always keep track of these dates to make sure you're working with the most current set.
- Revisions are often numbered and enclosed within a triangle.



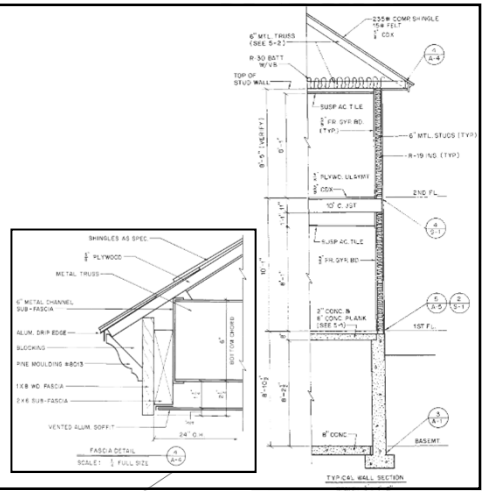
CALLOUTS

- A callout is a reference to an enlarged drawing or detail.
- BIM callouts are clickable! This feature can speed up the review enormously.



REFERENCE MARKS

- Reference marks indicate that additional information or an enlarged detail is provided on another sheet.



LEGEND

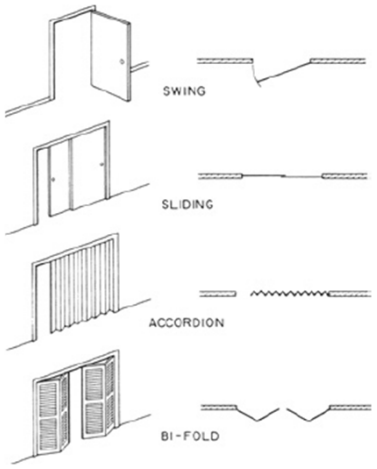
- The legend is used to define the symbols used in the construction plans.
- In some cases, similar symbols can have different meanings depending on the line of work being performed.
- Companies may also have their own symbols for certain items.

LEGEND

- In addition to the above mentioned, construction plans are also often composed of industry-specific symbols.
- Be sure you understand what those symbols represent by reviewing the legend for the drawing that you're working with.
- A roofing project, for example, will have symbols for items located on a roof such as HVAC units or skylights, while an electrical plan will have symbols for outlets and conduits.

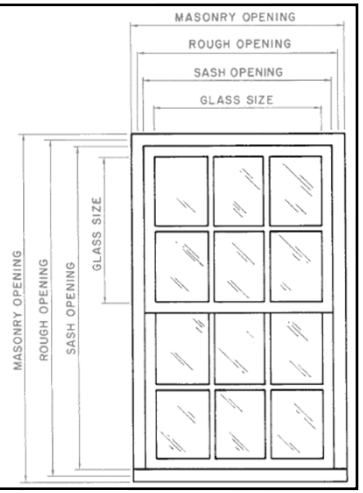
SYMBOLS

- Many construction features cannot be drawn exactly as they appear.
- Standard symbols show various materials, plumbing fixtures and fittings, electrical devices, windows, doors, etc.
- Not important to memorize all the symbols, since many architects and drafters use their own variations of standard symbols.



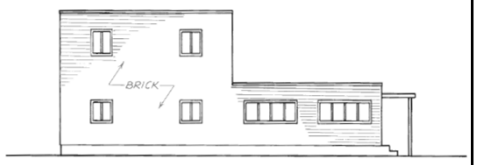
WINDOW SYMBOLS

- Windows are named and drawn according to how they open.
- Size is usually shown in nominal dimension



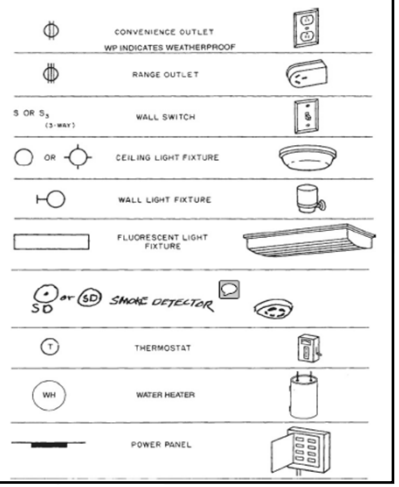
MATERIAL SYMBOLS

- When a large area is made up of one material, it is common to only draw the symbol in a part of the area.



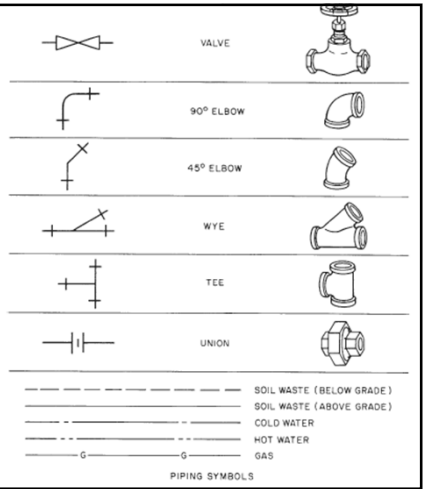
ELECTRICAL SYMBOLS

- Outlets and switches <u>are not</u> shown in actual position.
- Major fixtures and appliances <u>are</u> shown in actual position



MECHANICAL SYMBOLS

- Mechanical systems (e.g., plumbing, heating, ventilating, and air conditioning) are not shown in detail on drawings for single-family homes, but some important features may be shown.
- Piping is shown by lines.
- Different types of lines represent different kinds of piping



GENERAL NOTES

These are notes that apply to the whole project. Any information in the notes that conflict with the title block should be considered as the correct information. General notes supersede the title block information.

NOTES

These notes typically apply to an specific sheet or drawing .

KEYNOTES

Notes with a reference number. They are used to describe the project without cluttering the drawings.

NOTES

- Some elements are more easily described verbally than drawn. Notes are a tool used by the architect will use to illustrate them.
- Often you will see a table of notes on the side of a sheet with numbers describing the note on the plan (shown by a number with a circle, square, or triangle around it)
- Other times, there may be a single sheet called Numbered Drawing Notes, that consolidates all of the drawing notes for an entire set.

NOTES

- Some architects may organize numbered notes into a CSI (Construction Specifications Institute) method utilizing 1-16 or even more Divisions that categorize the drawing notes into subsections.

  For example: a note "4-127" may refer to a type of Masonry, as Division 4 represents Masonry.
- Look at the notes that have a leader (arrow) to the assembly, this information is usually vital.
- **Remember to <u>read all the notes on a page.</u>**

ABBREVIATIONS

- Hundreds of abbreviations are used to convey building components and related information. While many are common and typically standardized, abbreviations can differ from one architect or engineer to another and from one discipline to another.
- For example an abbreviation used on an architectural plan, may mean something entirely different on the electrical plan.

ABBREVIATIONS

- To clarify their intent, the architect or engineer provides a key, typically on the first sheet, that relates the symbols and their intended meaning.
- As you start to review any construction plan, familiarize yourself with those symbols and what they mean.
- Typically terms with five letters or fewer should not be abbreviated.

SECTION 100: PLANS

SITE LOCATION PLAN

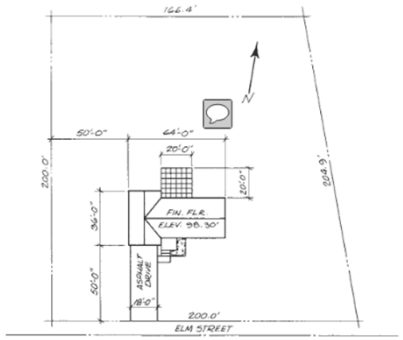
- It shows the location of the site as well as the major components within the project.
- It should not be confused with the site plan, which indicates the geographical location of the building.

SITE PLAN

Indicates the actual geographical location of the building.

Minimum requirements on a site plan:

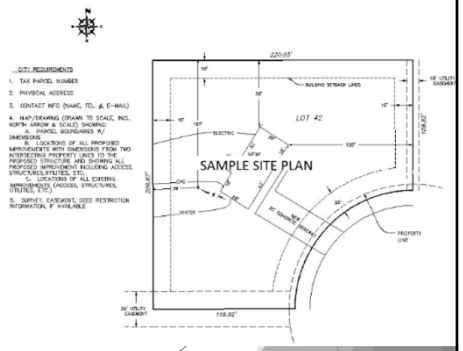
- Site information and where the building will be constructed.
- Boundary is shown with a heavy line or with one or two short dashes between longer line segment.
- North Arrow: Compass direction the site faces indicating the building's position on the site.



SITE PLAN

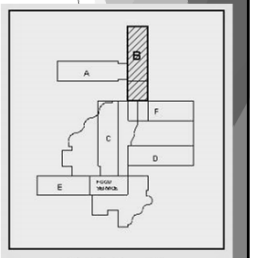
Depending on the complexity of the project, civil plans drawings may be required to show:

- existing site conditions
- proposed plan for re-grading
- water drainage or water retention
- sanitary and storm drain sewer systems
- electrical, water and gas utility service locations
- parking lots, curbs, sidewalks
- landscaping plans, etc.



KEY PLANS

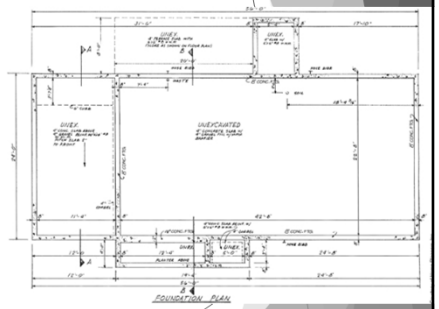
- Large buildings will divide the plans in sections and provide a key plan on the tittle block , to help us orient ourselves.



Building B

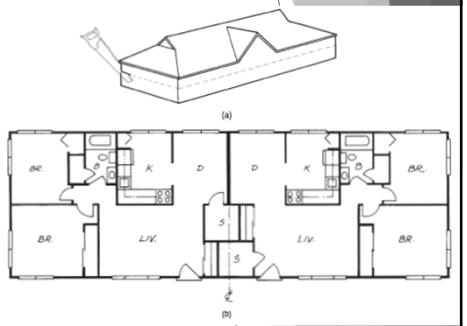
FOUNDATION PLANS

Shows foundation walls and structural work to be done below living spaces.



FLOOR PLANS

- Show:
  - Interior and exterior walls
  - Door and window locations
  - Room dimensions
  - Stairs, cabinets, toilets and sinks, and other relevant information.
- The section view is typically taken at a height of 3ft +/-
- They are drawn to scale (usually ⅛" or ¼" scale. House plans are typically drawn at 1:48. scale.



ROOF PLANS

- Roof plans show dormers, hips, valleys, roof drains, roof pitch, roof-mounted equipment and sometimes additional details including material assemblies, penetrations, vents, etc.

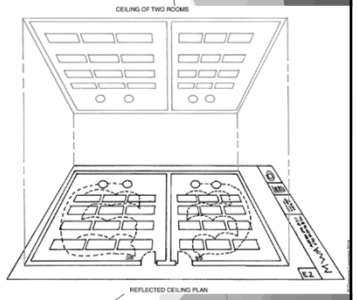
MIRRORED PLANS

A mirrored or reversed plan view is similar to what would be seen by looking at the plan in a mirror.

REFLECTED CEILING PLAN

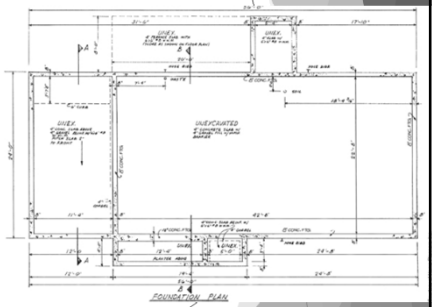
Reflected ceiling plan (RCP) is named so because it is a mirror image (reflected) view of the floor plan.

They show the lighting, sprinklers, smoke detectors, and any other objects that are located in or on the **ceiling**, such as the mechanical air diffusers and grilles.



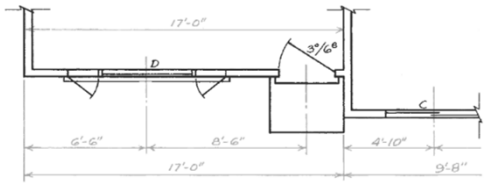
PLAN DIMENSIONS

- On frame construction, exterior walls are dimensioned to outside face of wall framing. If walls are to be covered, material is outside the dimensioned face of wall frame. This can be problematic with tight fire separation distances.
- Interior partitions may be dimensioned to centerlines or face of studs.



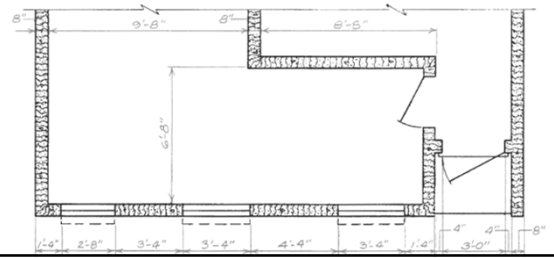
OPENING DIMENSIONS

- Windows and doors may be dimensioned about their centerlines, or edges of openings.



MASONRY DIMENSIONS

- Solid masonry construction is dimensioned entirely to face of masonry
- Masonry openings for doors and windows are dimensioned to the edge of openings.



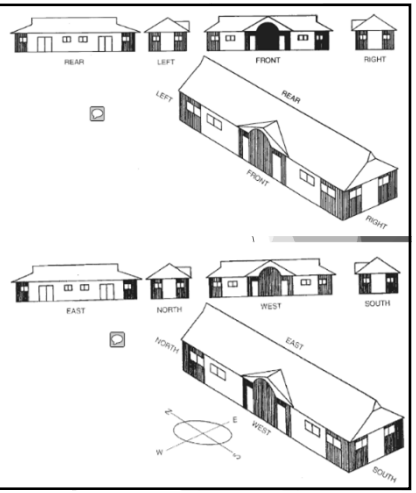
SECTION 200: BUILDING ELEVATIONS

EXTERIOR ELEVATION DRAWINGS

- Exterior elevations are side views showing each of the exterior walls of the building. They are typically identified as north, south, east, and west and cross-referenced on the first floor plan.
- They show:
  - The outline of the building
  - Openings, doors and windows
  - Roof shape and materials
  - Projections such as eaves and pipes.
  - Level datums such as the finished ground level and floor levels.
  - Dimensions, wall lengths , control joints and heights.
  - Exterior features such as decks porches and steps.
  - Any portion of the foundation that may be visible.
  - Wall finishes.

EXTERIOR ELEVATIONS

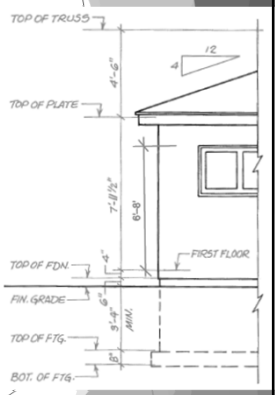
- Exterior elevations can be named according to
  - Compass directions (e.g., side that faces north is the north elevation)
  - Their relative positions (front, rear, left, right)



ELEVATION DIMENSIONS

▶Dimensions include:

- ▶Thickness of footing
- ▶Height of foundation walls
- ▶Top of foundation to finished first floor
- ▶Finished floor to ceiling or top of plate
- ▶Finished floor to bottom of window headers
- ▶Roof overhang at eaves
- ▶The underground portion of the building should be shown in dash lines.



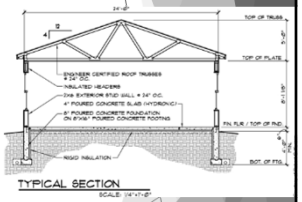
SECTION 300: BUILDING SECTIONS

SECTION DRAWINGS

- A section drawing shows a view of the structure as if it had been sliced in half.
- It shows the relationships between the different parts of the building that are difficult to show in plan view.
- Sections show how each component relates to the others. They are basically 'slices' through a building or building component.

BUILDING SECTIONS

- Sections are cross referenced on plan views, and elevations, so the reader can understand where the relevant 'slice' was taken.
- A simple residence may only require a few wall sections, since the information will be typical. More complicated projects require dozens of wall sections to describe all the various conditions



SECTION 400: LARGE SCALE VIEWS

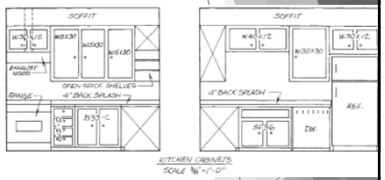
WALL SECTIONS, INTERIOR ELEVATIONS, ETC.

WALL SECTIONS

- Another common 'section' is a Wall Section.
- This is a vertical slice through the wall that shows the inside, outside and interior components within the wall itself, such as studs, sheathing, insulation, siding, or masonry, as well as how the wall engages the floor or foundation below, and the roof or floor structure above.

INTERIOR ELEVATION DRAWINGS

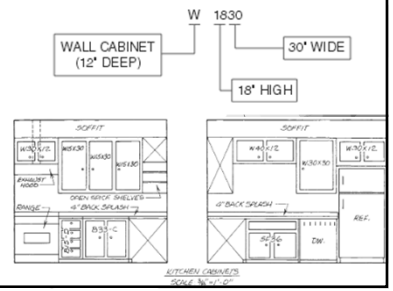
- Interior elevations may also be provided when a plan view alone can't communicate what is needed, like mounting heights for cabinets and countertops and bathroom fixtures.



CABINET ELEVATIONS

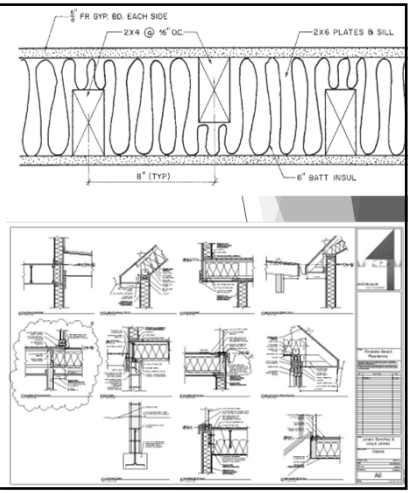
- Base cabinets are a standard height/depth
- Wall cabinet have standard depth (front to back).
- Width and height vary.

LETTER	CABINET TYPE
W	WALL CABINET
WC	CORNER WALL CABINET
B	BASE CABINET
D OR DB	DRAWER BASE CABINET
BC	BASE CORNER CABINET
RC	REVOLVING CORNER CABINET
SF	SINK FRONT (ALSO FOR COOKTOP)
SB	SINK BASE (ALSO FOR COOKTOP)
U	UTILITY OR BROOM CLOSET
OV	OVEN CABINET



DETAIL DRAWINGS

- Detail drawings might describe components such as footings, sills, flashing, etc.
- They should be drawn at a large scale and include information such as materials, dimensions, etc.
- Details drawings should not duplicate information included in the project specifications as this may cause confusion.



SECTION 500: DETAILS

SECTION 600: SCHEDULES AND DIAGRAMS

SCHEDULES

ROOM	FLOOR	WALLS	CEILI G
KITCHEN	QUARRY TILE	GYP. BD. W/WALL PAPER	12"x12" TILE
DINING ROOM	OAK PARQUET	GYP. BD.	GYP. BD.
LIVING ROOM	CARPET/PART. BD.	GYP. BD.	GYP. BD.
FAMILY ROOM	CARPET/PART. BD.	N.D. BD. PANEL/GYP. BD.	GYP. BD.
BEDROOM #1	CARPET/PART. BD.	GYP. BD.	GYP. BD.
BEDROOM #2	CARPET/PART. BD.	GYP. BD.	GYP. BD.
BEDROOM #3	CARPET/PART. BD.	GYP. BD.	GYP. BD.
BATH #1	CERAMIC TILE	CERAMIC TILE/CONC. BD.	MOISTURE RESIST. GYP. BD.
BATH #2	CERAMIC TILE	CERAMIC TILE/CONC. BD.	MOISTURE RESIST. GYP. BD.
CLOSETS	CARPET/PART. BD.	GYP. BD.	GYP. BD.
FOYER	SLATE	GYP. BD. W/WALL PAPER	GYP. BD.

- Many building components are organized in simple tables called 'schedules.'
- Door, frame and door hardware details will be described in a door schedule.
- The floor plan will have simple door number or mark, and that will correspond with the detailed information on the door schedule.
- Windows, finishes, lighting fixtures, and HVAC air flow requirements are all typically detailed in schedules.

SECTIONS 700-800: USER DEFINED

CATCH-ALL DIVISION

BUILDING SPECIFICATIONS

Large and complex buildings require a lot of additional information to be conveyed.

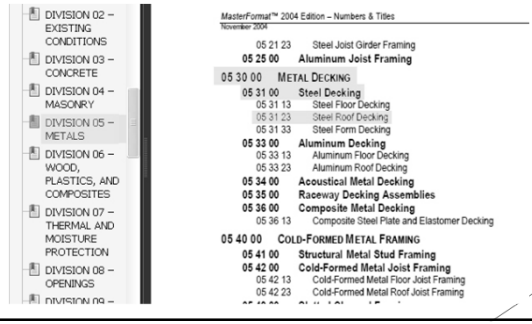
The Construction Specifications Institute's MasterFormat
Standardizes titles and section numbers
Up to 49 divisions, numbered sections in each division

CSI STANDARDS

- MASTER FORMAT®: Used for specifications, estimates and product data.
  UNIFORMAT®: Organizes Preliminary Project Descriptions, cost estimates, BIM objects, and early project information.
- SECTION FORMAT®: Organizes and formats the text for specification pages.
- OMNICLASS®: Provides a classification structure for electronic databases and software. Especially useful in Building Information Modeling (BIM).

CSI SPECIFICATION DIVISIONS

There are 49 divisions to organize construction specifications.



CSI SPECIFICATION DIVISIONS

It's completely unnecessary to memorize the CSI divisions.

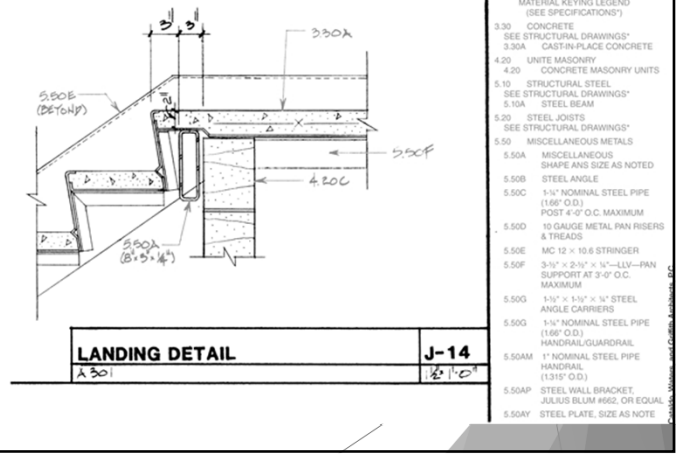
LEARN THE SIXTEEN CSI SPECIFICATION DIVISIONS

Remember

Good **S**trong **C**erveza **M**akes **M**e **W**illing **T**o **D**ate **F**at **S**enoritas;
Even **F**at **S**enoritas **C**overed in **M**easles **E**verywhere.

Good = **General** Conditions 1
Strong = **Sitework** 2
Cerveza = **Concrete** 3
Makes = **Masonry** 4
Me = **Metal** 5
Willing = **Wood** & Plastics 6
To = **Thermal**/ Moisture Protection 7
Date = **Doors** & Windows 8
Fat = **Finishes** 9
Senoritas; = **Specialties** 10
Even = **Equipment** 11
Fat = **Furnishings** 12
Senoritas = **Special** Construction 13
Covered = **Conveying** Systems 14 (in)
Measles = **Mechanical** 15
Everywhere = **Electrical** 16

DETAIL NOTES USING CSI SPECIFICATION DIVISIONS



CSI SPECIFICATION DIVISIONS

On residential projects we may see a simplified version of the CSI divisions.

Division	Title
1	General Requirements
2	Existing Conditions
3	Concrete
4	Masonry
5	Metals
6	Wood, Plastics, and Composites
7	Thermal and Moisture Protection
8	Openings
9	Finishes
10	Specialties

BUILDING SPECIFICATIONS

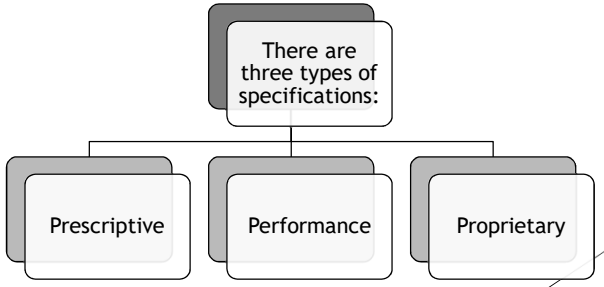
Specifications are usually printed on a separate binder, but some architects may include the specifications on the drawing sheets (to insure that the specs will not be misplaced).

BUILDING SPECIFICATIONS

Specifications contain:

- Descriptions of methods and materials used in the project
- Quality standards, materials, model numbers, and other characteristics of projects
- Testing methods, quality control information, geotechnical data, and other information useful in building the project.
- They are often numbered per CSI standards or a simplified version of it.

BUILDING SPECIFICATIONS



PRESCRIPTIVE SPECIFICATIONS

Contain detailed descriptions of what specific materials must be used as well as the installation instructions.

It has three key components:
- *General provisions (Code)*
- *Required products (project type)*
- *Execution procedures (install / test)*

Prescriptive specs put a greater burden on the ARCHITECT to ensure proper installation.

PRESCRIPTIVE SPECIFICATIONS

Addresses the operational requirements of an installation. The focus is on the project outcome, indicating how the final project must be able to function

The architects provide direction to the general contractor about what is needed and the general contractor must determine the best path to achieve the desired outcome

Prescriptive specs put a greater burden on the CONTRACTOR to ensure proper installation.

PROPRIETARY SPECIFICATIONS

Demand that **only one specific product** be used for a given installation. It is commonly utilized if the portion of a project requires a certain performance that only one product can achieve.

OPEN SPECS: The architect doesn't name a specific supplier or product and allows for substitutions to be made by the contractor. (i.g. **3M™ Thinsulate™** "or equal")

CLOSED SPECS: The architect lists specific products, systems and manufacturers, with no alternatives or mechanisms to apply a substitution. (i.g. **3M™ Thinsulate™**)

Proprietary specifications typically drive up cost.

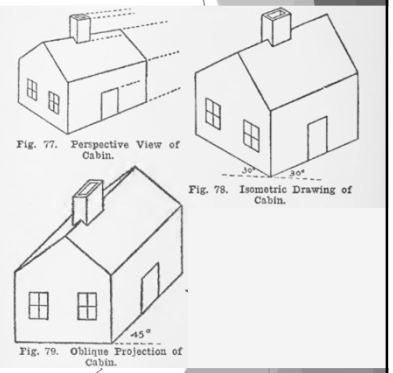
SECTION 900: 3D VIEWS

WHAT ARE 2-D ILLUSTRATIONS?

- Construction plans typically consist of many two-dimensional drawings that explain the details of a project.
- The two dimensions represented are: length and height.

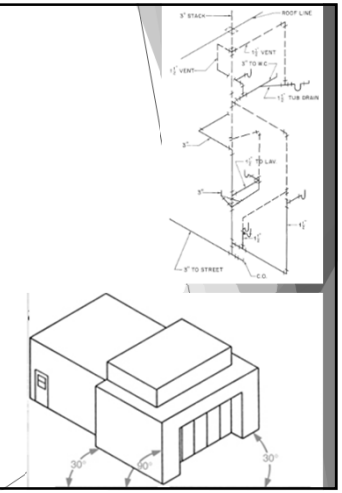
WHAT ARE 3-D ILLUSTRATIONS?

- Construction plans may contain 3-dimensional drawings. They may be:
  - Perspective
  - Axonometric
  - Isometric
  - Oblique
  - Orthographic
- The three dimensions represented are: Length, height and width.



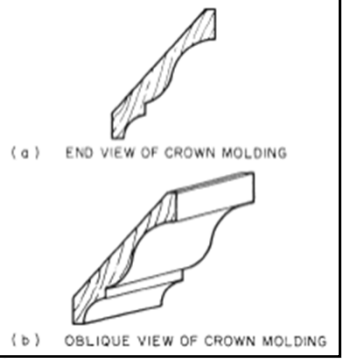
ISOMETRIC DRAWINGS

- Isometric drawings as very simple 3-D drawings.
- The vertical lines are drawn vertically and the horizontal lines are drawn at an angle of 30° from horizontal.
- Single-line plumbing isometric drawings are quite common.



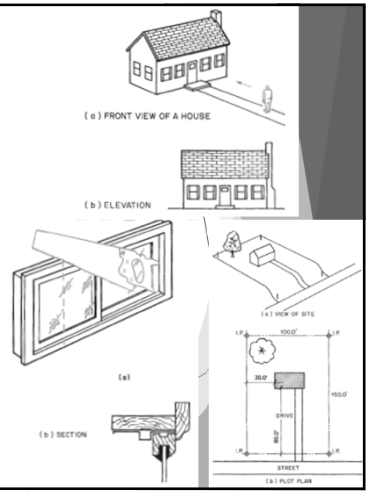
OBLIQUE DRAWINGS

- Oblique drawings are often used when an irregular shape is to be shown.
- The most irregular surface is drawn in proportion as though it were flat against the drawing surface.
- Parallel lines are added to show depth.
- Oblique drawings are often used to show decorative profiles.



ORTHOGRAPHIC DRAWINGS

- Most architectural drawings are orthographic projections.
- They show all surfaces parallel to plane of projection.
- Views are shown in proportion to actual size and shape.
- Surfaces that are not parallel are not shown in proportion, for example walls at an angle are not shown



WHAT ARE 4-D ILLUSTRATIONS?

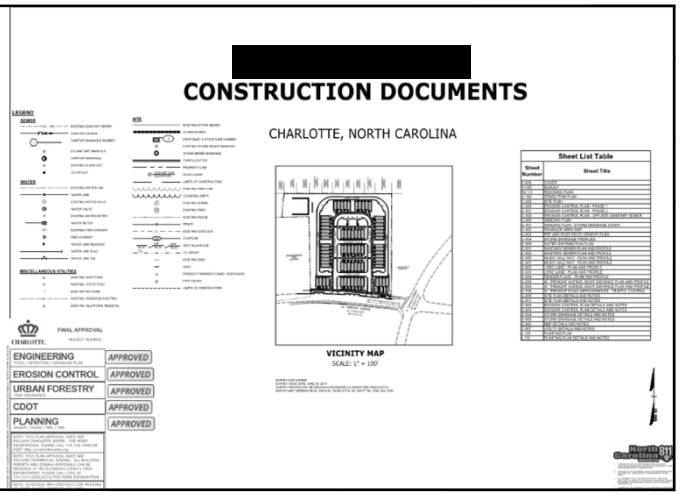
- A 3D building walkthrough is sometimes referred to as a 4-D drawing.
- They are typically found in BIM designs (Building Information Modeling).
- The four dimensions represented are: length, height, width and motion.

PHOTOGRAPHS

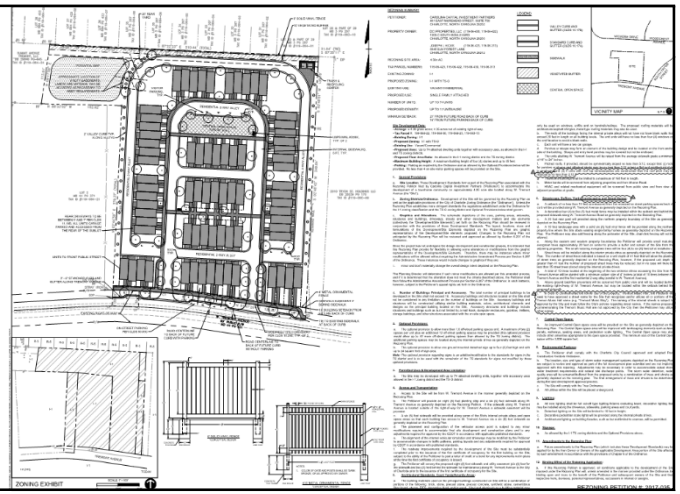
- Photographs may also be included on the plans to describe existing conditions.

CIVIL PLANS

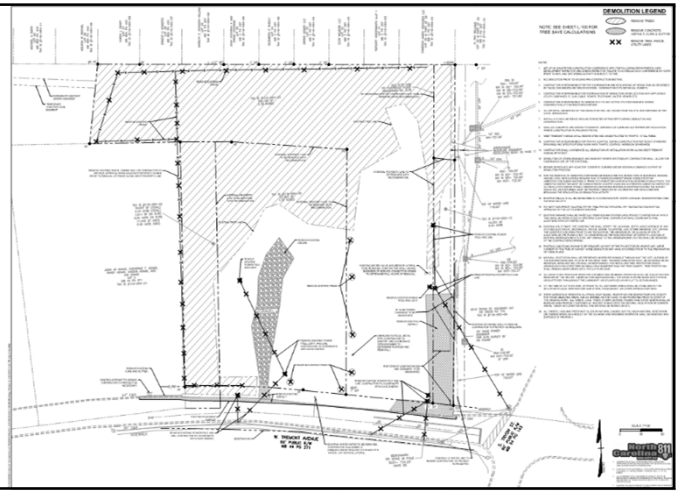
COVER SHEET



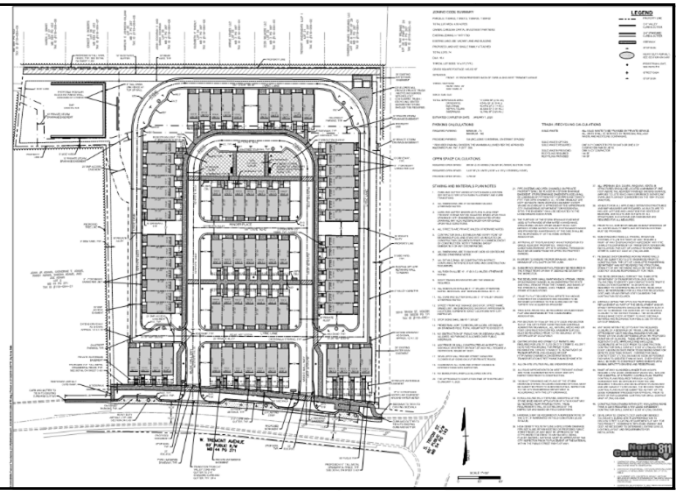
ZONING EXHIBIT



DEMOLITION PLAN

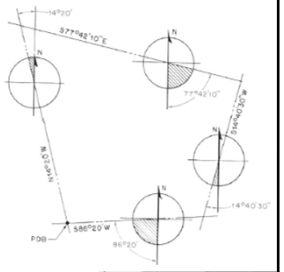


SITE PLAN



PLAT DRAWINGS

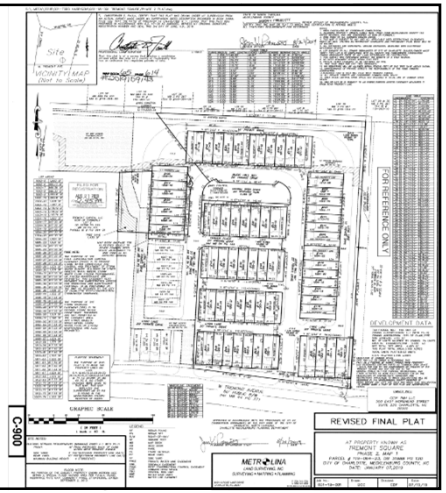
- Property lines are going to be found on the plat drawings.
- The direction of the property line is expressed as a bearing angle. A bearing angle is an angle between the line and north or south. It is measured north or south depending on which keeps bearing under 90°. Angles are measured in degrees(°), minutes (’), and seconds (”)
- Point of beginning (P.O.B.) may or may not be shown on the site plan.



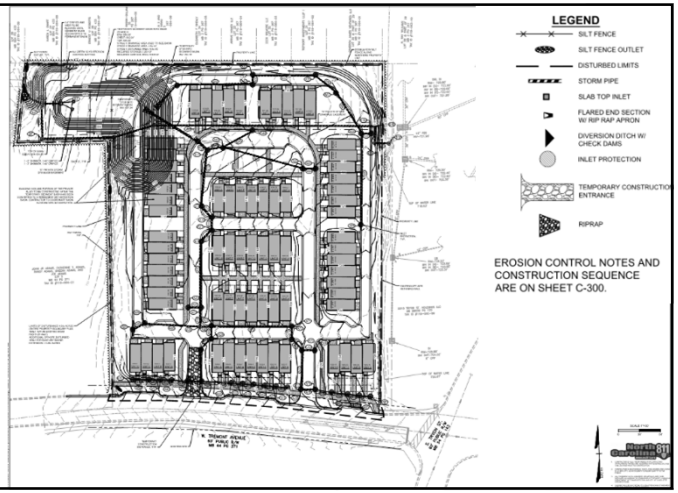
PLAT DRAWINGS

.

Egress compliance and property lines location are going to be important for the building reviewer.



EROSION CONTROL PLAN



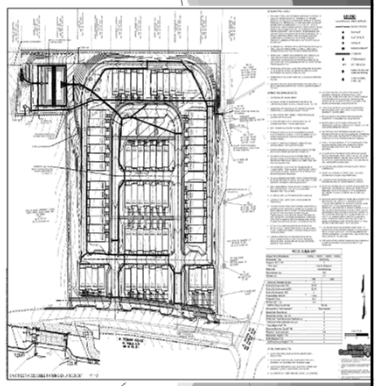
GRADING PLAN & GRADING CHART

Topographic contour lines show site grade.

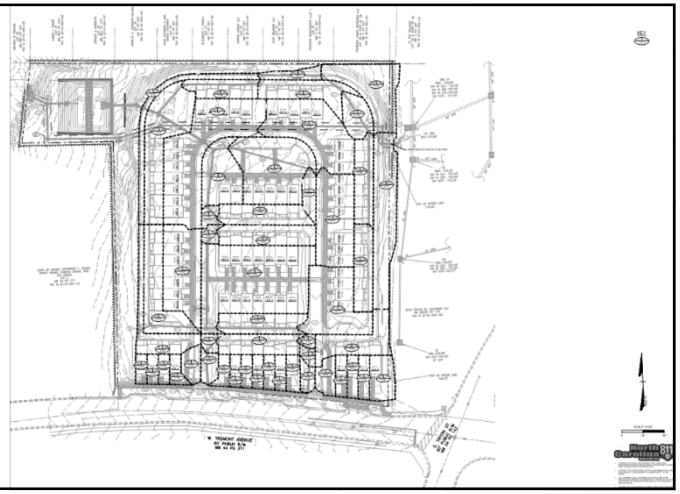
- Broken lines indicate natural grade (N.G.)
- Solid lines indicate finished grade (F.G.)

Vertical contour interval is the vertical difference between contour lines.

Retaining walls and accessibility grading are going to be important for the building reviewer.



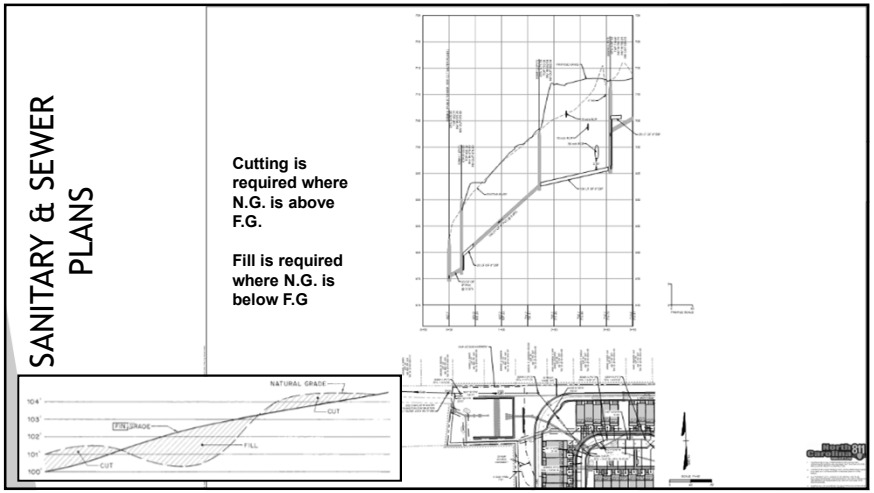
DRAINAGE PLAN



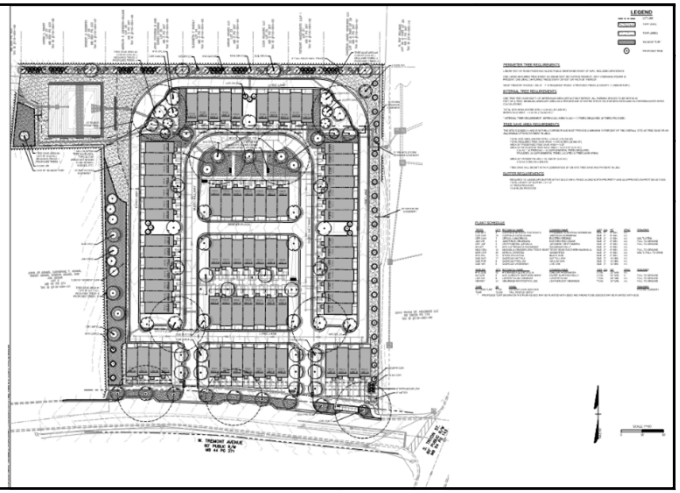
SANITARY & SEWER PLANS

Cutting is required where N.G. is above F.G.

Fill is required where N.G. is below F.G

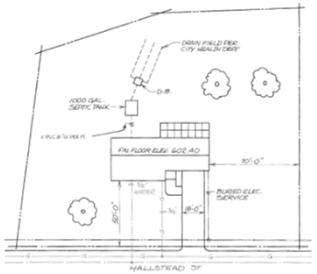


LANDSCAPING PLANS

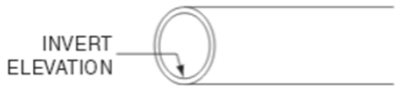


SITE UTILITIES

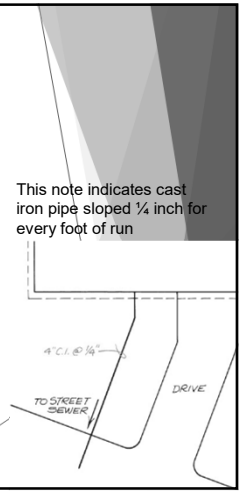
Partial site plan with utilities indicated



Invert elevation is the elevation at the lowest point inside the pipe



This note indicates cast iron pipe sloped ¼ inch for every foot of run

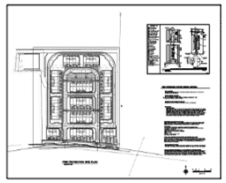


FIRE PROTECTION PLANS

FIRE PROTECTION PLAN

They explain:

- Project information, design criteria and applicable standards
- The fire protection features and their location on the building.
- The design approach and specifications.



FIRE SPRINKLER SYSTEM DESIGN CRITERIA

POINT OF CONNECTION
FIRE LINE POINT OF CONNECTION STARTS AT THE STREET CIRCULATING WATER MAIN WITH A 2 CPVC FIRE LINE CONNECTION SERVING EACH BUILDING

APPLICABLE STANDARDS TO BE APPLIED
2018 NORTH CAROLINA STATE BUILDING CODE
NFPA 13R, INSTALLATION OF SPRINKLER SYSTEMS IN RESIDENTIAL OCCUPANCIES UP TO AND INCLUDING FOUR STORIES IN HEIGHT, 2013 EDITION

CLASSIFICATION OF HAZARD/ OCCUPANCY FOR EACH AREA
TOWNHOMES (R-3) WILL BE PROTECTED IN ACCORDANCE WITH NFPA 13R REQUIREMENTS

DESIGN APPROACH
DWELLING UNIT DESIGN
SYSTEM BASED FOR THE UNITS WILL BE TO INCLUDE FOUR ADJACENT SPRINKLERS THAT PRODUCE THE GREATEST WATER DEMAND FROM WITHIN A COMPARTMENT. ALL SPRINKLERS SHALL BE LISTED RESIDENTIAL FAST RESPONSE. TEMPERATURE RATING OF SPRINKLERS IN AIR-CONDITIONED AREAS WILL BE ORDINARY TEMPERATURE RATED OR INTERMEDIATE TEMPERATURE RATED. WET PIPE AUTOMATIC SPRINKLER SYSTEM USING CPVC PLASTIC PIPING LOCATED ABOVE THE CEILING, WITH DROPS TO RESIDENTIAL PENDENT HEADS BELOW THE CEILING. ANY EXPOSED PIPING IS TO BE INSTALLED USING STEEL PIPE, UNLESS ALLOWED BY LISTING OF CPVC PIPE. CALCULATIONS SHALL CONFORM TO EITHER THE RESIDENTIAL SPRINKLER HEAD MANUFACTURER'S CPVC FLOW SPECIFICATIONS FOR THE HEAD AND COVERAGE AREA SELECTED OR A .05 DENSITY, WHICH EVERY IS GREATER.

CHARACTERISTICS OF THE WATER SUPPLY TO BE USED
WATER IS BEING SUPPLIED FROM A 6" CITY WATERMAIN OF CIRCULATING TYPE, LOCATED ALONG TREMONT AVENUE. REFERENCE SHEET FP1.1 INDICATING ROUTING OF WATER MAINS TO THE CITY SUPPLY AND FIRE MAINS TO THE BUILDING. THE ADEQUACY OF THE WATER SOURCE HAS BEEN VERIFIED BY A CURRENT FLOW TEST.

FLOW TEST DATA
THE FLOW TEST WAS PERFORMED BY CHARLOTTE FIRE DEPARTMENT FIRE PREVENTION BUREAU.
THE RESULTS OF THE TEST INDICATE ADEQUATE WATER SUPPLY AND PRESSURE FOR THE PROPOSED HAZARDS.
THE RESULTS OF THE TEST ARE:
LOCATION OF TEST HYDRANT: 420 TREMONT AVENUE
HYDRANT BUTTS USED FOR TEST HAD 0.9 CO-EFFICIENT.
STATIC = 72 PSI
RESIDUAL = 64 PSI
TOTAL FLOW = 1,112 GPM, PITOT: 44 PSI
DATE: 01/11/19 TIME: 9:30 AM

VALVING & ALARM REQUIREMENTS TO MINIMIZE POTENTIAL AND UNRECOGNIZED FLOW OF WATER
A PADDLE TYPE WATER FLOW INDICATOR SHALL BE INSTALLED ON EACH INDIVIDUAL FIRE SPRINKLER SYSTEM RISER. THE VALVES ON THE BACKFLOW DEVICE SHALL HAVE TAMPER SWITCHES INSTALLED ON THEM AND THE BACKFLOW SHALL SERVE AS THE SYSTEM CONTROL VALVE. THESE DEVICES SHALL BE MONITORED BY A FIRE ALARM SYSTEM WITH REMOTE STATION MONITORING. ALL FIRE ALARM DEVICES AND INSTALLATION SHALL COMPLY WITH NFPA 72, 2013 EDITION.

BACKFLOW PREVENTION SPECIFICATIONS
EACH BUILDING WILL HAVE A 2" DOUBLE CHECK BACKFLOW PREVENTOR AND WILL BE LOCATED IN THE RISER ROOM ON THE SIDE OF THE BUILDING. SEE SITE PLAN FOR PIPE ROUTING OF FIRE LINES. FDC IS TO BE WALL MOUNTED

QUALITY AND PERFORMANCE SPECIFICATIONS OF ALL SEMI AND MINIMUM FIRE PROTECTION COMPONENTS
ALL MATERIALS USED, NEW AND SALVAGED FOR THIS FACILITY SHALL BE OF THE LISTED OR F.M. APPROVED FOR THEIR PURPOSE AND OR FUNCTION THEY SERVE. ALL MATERIALS SHALL BE APPROVED BY THE AUTHORITY HAVING JURISDICTION. MATERIAL DATA SHEETS SHALL BE PROVIDED WITH THE INSTALLING CONTRACTOR'S SUBMITTAL PACKAGE. FIRE PROTECTION CONTRACTOR SHALL PRODUCE SHOP DRAWINGS AND HYDRAULIC CALCULATIONS PRIOR TO INSTALLING ANY PIPE. DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED TO THE CITY OF CHARLOTTE FOR APPROVAL.

STRUCTURAL PLANS

STRUCTURAL PLANS

Structural plans focus on the structural components of the building. They describe:

- The foundation work
- Framing and floor construction
- Reinforcing and connection details.

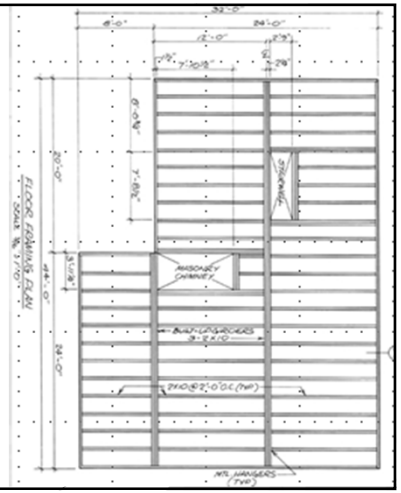
STRUCTURAL PLANS

- Keep in mind that most structural engineers stop their scope of work within 5-feet of the building.
- As a consequence, other required structural work is overlooked.

  Example: retaining walls

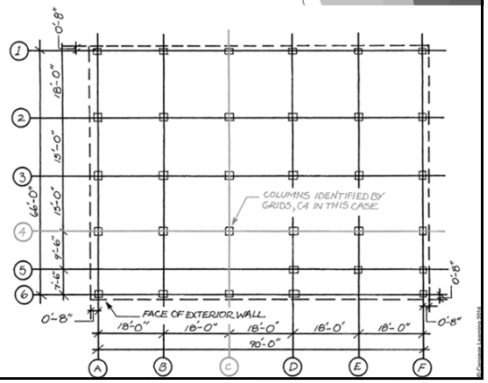
STRUCTURAL PLANS

- Double-line framing plan shows:
  - Joist headers
  - Bearing for inner ends of joists
  - Size and type of framing materials
  - Length of joists
  - Spacing
  - Framing at openings



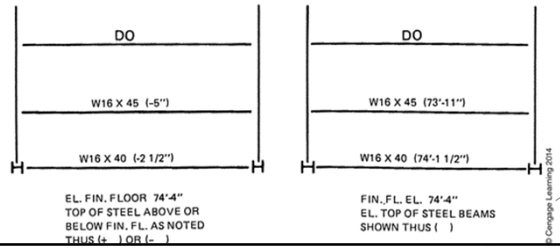
STRUCTURAL GRID

- Columns/details can be referenced to the grid.
- Columns located by grid line through their centers
- Major components are located by dimensions referenced to grid lines



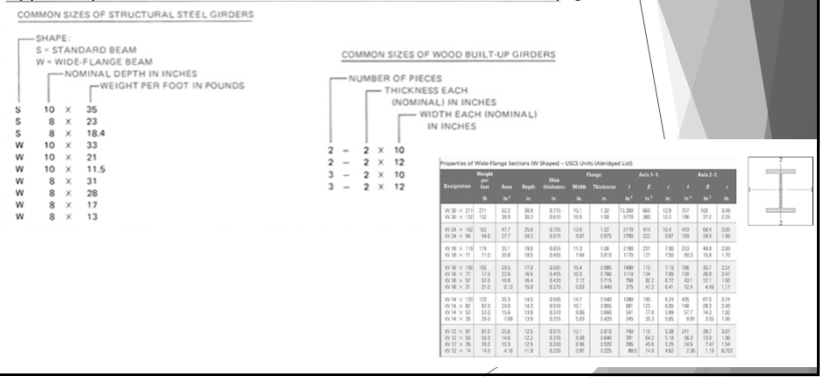
BEAM ELEVATIONS

- Notations on the drawings indicate the relative elevations of beams



STRUCTURAL PLANS

Typical specifications for structural steel and wood built-up girders

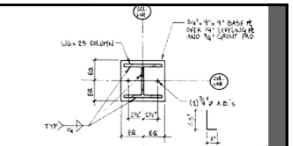


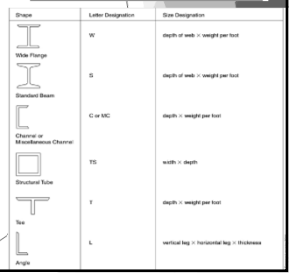
STRUCTURAL PLANS

I-beams (I-shaped cross-section)
W - Wide flange steel beam (I-shaped cross-section) have parallel flange surfaces.
S - American Standard Beam (I-shaped cross-section) have a slope on the inner flange surfaces.
HP - Bearing Pile (H-shaped cross-section) have parallel flange surfaces and **equal** web and flange thicknesses.
M - Miscellaneous shapes cannot be classified as standard i-beams (W,S,HP), available from a limited number of manufacturers.

Channels (C-shaped cross-section)
C - American Standard Channels have a slope on the inner flange surfaces.
MC -American Miscellaneous Channels cannot be classified as standard channels, available from a limited number of manufacturers.

Angles (L-shaped cross-section)
L - shapes are equal leg and unequal leg angles.

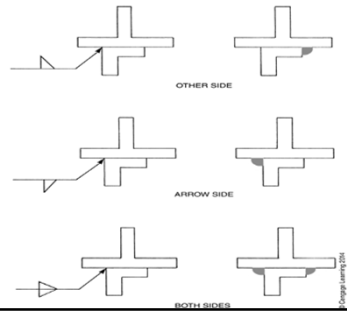


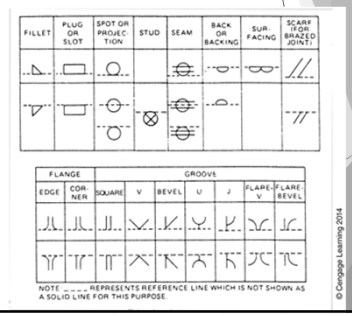


STRUCTURAL PLANS

American Welding Society (AWS)

Standard system for welding symbols

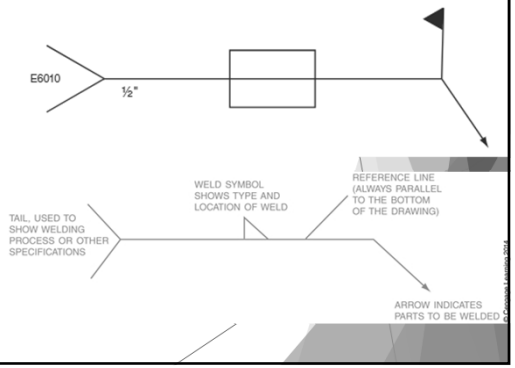




STRUCTURAL PLANS

The field weld symbol indicates weld is to be done in the field.

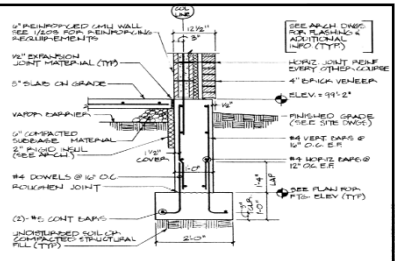
This is a is a 1/2-inch plug weld on both sides of the part and is to be done with E6010 electrode or filler metal



FOOTING SCHEDULES

Footing or retaining wall schedules are an efficient way to provide information for multiple elements.

The remarks sections can provide important information.



TYPICAL WALL SECTION

FOOTING SCHEDULE

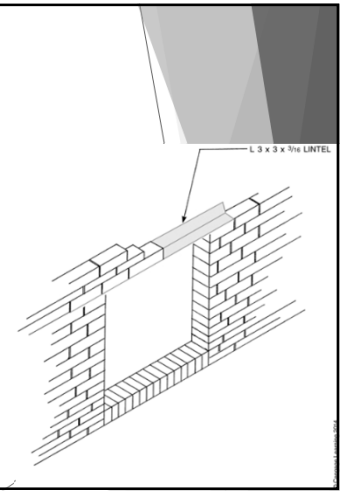
MARK	SIZE	REINF.	REMARKS
F1	5'-0" x 5'-0" x 12"	(4) #5 BARS EA. WAY	
F2	4'-0" x 4'-0" x 12"	(4) #5 BARS EA. WAY	
F3	4'-0" x 4'-0" x 12"	(5) #5 BARS EA. WAY	
F4	5'-0" x 4'-0" x 24"	(4) #5 SHORT BARS (7) #5 LONG BARS	OVERPOUR EXISTING BUILDING FOOTING (SIM. TO 14/S101)

LINTEL SCHEDULES

Actual lengths of members are not shown on general contract drawings.

LINTEL SCHEDULE

MARK	MATERIAL	TYPE	MAS. OPNG	REMARKS
L1	WT8 x 13	⊥	SEE AFVH	ATTACH ONE END TO COL. SEE 1/S200
L2	WT8 x 13	⊥	"	END BEARING BOTH ENDS
L3	WT8 x 13	⊥	"	CONTINUOUS W/CENTER SUPPORT ON T.S. 4x4
L4	WT 4x9	⊥	"	AT ALL BELOW WINDOW UNIT VENTILATOR OPENINGS
L5	(2) ∠ 6x4x 5/16 W/ 1/4" x 9 1/2 CONT. BOT PL	⊥⊥	"	LINTEL IN FIRE WALL. WELD BOT. PL TO ANGLES.
L6	(2) ∠ 6x4x 5/16	⊥L	"	IN EXIST. BLDG WALL
L7	(3) ∠ 4 x 3 1/2 x 5/16	⊥⊥L	"	AT CAFETERIA HVAC UNIT WALL OPENINGS COORDINATE WITH 4-7/H3 AND A103 (2 LOCATIONS)



ELECTRICAL PLANS

for commercial building reviewers

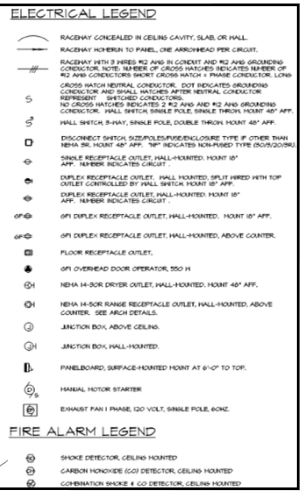
ELECTRICAL COVER SHEET

Will include general info, legends, equipment and abbreviations.

ELECTRICAL SYMBOL LEGEND

An electrical symbol legend shows the graphic notations used to represent various electrical and electronic devices.

Fire alarm symbols and location are going to be important for the building reviewer.


ELECTRICAL LEGEND

RACEWAY CONCEALED IN CEILING CAVITY, SLAB, OR WALL.

RACEWAY HOMERUN TO PANEL, ONE ARROWHEAD PER CIRCUIT.

RACEWAY WITH 3 #12 AWG IN CONDUIT AND #12 AWG GROUNDING CONDUCTOR. NOTE: NUMBER OF CROSS HATCHES INDICATES NUMBER OF #12 AWG CONDUCTORS SHORT CROSS HATCH = PHASE CONDUCTOR. LONG CROSS HATCH NEUTRAL CONDUCTOR. DOT INDICATES GROUNDING CONDUCTOR AND SMALL HATCHES AFTER NEUTRAL CONDUCTOR REPRESENT SWITCHED CONDUCTORS. NO CROSS HATCHES INDICATES 2 #12 AWG AND #12 AWG GROUNDING CONDUCTOR. WALL SWITCH, SINGLE POLE, SINGLE THROW, MOUNT 48" AFF.

WALL SWITCH, 3-WAY, SINGLE POLE, DOUBLE THROW, MOUNT 48" AFF.

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GFI DUPLEX RECEPTACLE OUTLET, WALL-MOUNTED. MOUNT 18" AFF.

GFI DUPLEX RECEPTACLE OUTLET, WALL-MOUNTED, ABOVE COUNTER.

FLOOR RECEPTACLE OUTLET.

GFI OVERHEAD DOOR OPERATOR, 550 H

NEMA 14-30R DRYER OUTLET, WALL-MOUNTED. MOUNT 48" AFF.

NEMA 14-50R RANGE RECEPTACLE OUTLET, WALL-MOUNTED, ABOVE COUNTER. SEE ARCH DETAILS.

JUNCTION BOX, ABOVE CEILING.

JUNCTION BOX, WALL-MOUNTED.

PANELBOARD, SURFACE-MOUNTED MOUNT AT 6'-0" TO TOP.

MANUAL MOTOR STARTER

EXHAUST FAN 1 PHASE, 120 VOLT, SINGLE POLE, 60HZ.

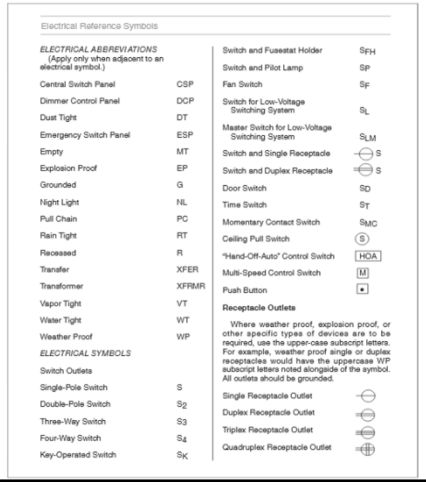
FIRE ALARM LEGEND

SMOKE DETECTOR, CEILING MOUNTED

CARBON MONOXIDE (CO) DETECTOR, CEILING MOUNTED

COMBINATION SMOKE & CO DETECTOR, CEILING MOUNTED

COMMON SYMBOLS


Electrical Reference Symbols

ELECTRICAL ABBREVIATIONS (Apply only when adjacent to an electrical symbol.)

Central Switch Panel	CSP
Dimmer Control Panel	DCP
Dust Tight	DT
Emergency Switch Panel	ESP
Empty	MT
Explosion Proof	EP
Grounded	G
Night Light	NL
Pull Chain	PC
Rain Tight	RT
Recessed	R
Transfer	XFER
Transformer	XFRMR
Vapor Tight	VT
Water Tight	WT
Weather Proof	WP

ELECTRICAL SYMBOLS

Switch Outlets

Single-Pole Switch	S
Double-Pole Switch	S_2
Three-Way Switch	S_3
Four-Way Switch	S_4
Key-Operated Switch	S_K
Switch and Fusestat Holder	S_{FH}
Switch and Pilot Lamp	S_P
Fan Switch	S_F
Switch for Low-Voltage Switching System	S_L
Master Switch for Low-Voltage Switching System	S_{LM}
Switch and Single Receptacle	S
Switch and Duplex Receptacle	S
Door Switch	S_D
Time Switch	S_T
Momentary Contact Switch	S_{MC}
Ceiling Pull Switch	(S)
"Hand-Off-Auto" Control Switch	HOA
Multi-Speed Control Switch	M
Push Button	

Receptacle Outlets

Where weather proof, explosion proof, or other specific types of devices are to be required, use the upper-case subscript letters. For example, weather proof single or duplex receptacles would have the uppercase WP subscript letters noted alongside of the symbol. All outlets should be grounded.

Single Receptacle Outlet	
Duplex Receptacle Outlet	
Triplex Receptacle Outlet	
Quadruplex Receptacle Outlet	

Duplex Receptacle Outlet (Split Wired)	
Triplex Receptacle Outlet (Split Wired)	
250-V Receptacle Single Phase. Use Subscript Letter to Indicate Function (DW—Dishwasher, RA—Range, CD—Clothes Dryer) or Numeral (with explanation in symbol schedule).	
250-V Receptacle Three Phase	
Clock Receptacle	C
Fan Receptacle	F
Floor Single Receptacle Outlet	
Floor Duplex Receptacle Outlet	
Floor Special-Purpose Outlet	*
Floor Telephone Outlet (Public)	
Floor Telephone Outlet (Private)	

Example of the use of several floor outlet symbols to identify a 2, 3, or more gang flow outlet.

Underfloor duct and junction box for triple, double, or single duct system as indicated by the number of parallel lines.

Example of use of various symbols to identify location of different types of outlets or connections for underfloor duct or cellular floor systems.

Cellular Floor Header Duct

*Use numeral keyed to explanation in drawing list of symbols to indicate usage.

Circuiting

Wiring Exposed (Not in Conduit)	E
Wiring Concealed in Ceiling or Wall	
Wiring Concealed in Floor	
Wiring Existing*	
Wiring Turned Up	
Wiring Turned Down	
Branch Circuit Home Run to Panel Board	

Number of arrows indicates number of circuits. (A number of each arrow may be used to identify circuit number.)*

Bus Ducts and Wireways

Trolley Duct*	T T
Busway (Service, Feeder, or Plug-in)*	B B
Cable Trough Ladder or Channels*	C C
Wireway*	W W

Panelboards, Switchboards, and Related Equipment

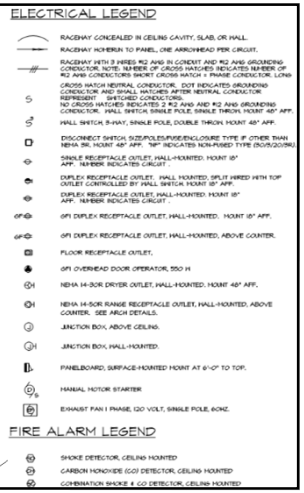
Flush-Mounted Panelboard and Cabinet*	
Surface-Mounted Panelboard and Cabinet*	
Switchboard, Power Control Center, Unit Substations (Should be drawn to scale.)*	
Flush-Mounted Terminal Cabinet (In small scale drawings the TC may be indicated alongside the symbol.)*	TC
Surface-Mounted Terminal Cabinet (In small scale drawings the TC may be indicated alongside the symbol.)*	TC

ABBREVIATIONS

Keep in mind that although NCS has over 2600 stablished abbreviations and symbols many electrical designers do not follow it.

Per NCS:

Touch panel = “TPAN”,
but the may abbreviate it “TPL”.
Source of teleconference signal = “SRC”,
but they may abbreviate it “STS”.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COMBINATION SMOKE & CO DETECTOR, CEILING MOUNTED

ELECTRICAL SCHEDULES

- An electrical schedule lists all the light fixtures used in the project.
- Information about each fixture is shown on the schedule, including the light fixture description, manufacturer, voltage, wattage, and notes.
- Rated fixtures are going to be important for the building reviewer.


LIGHTING FIXTURE SCHEDULE

TYPE	SYMBOL	FIXTURE DESCRIPTION	MOUNTING	VOLTS	INPUT WATTS	MANUFACTURER	PART #	ITEM #	REMARK
D		SIGNATURE 6" LED SATIN WHITE LOW-PROFILE FLUSH MOUNT CEILING LIGHT, LED BULB	RECESSED CEILING	120	12	PROGRESS LIGHTING FIXTURES	--	P800007-028-30K	OR EQUIVALENT
K		KEYLESS CEILING MOUNTED EXPOSED, LED BULB	SURFACE CEILING	120	18	SPECIFIED BY OWNER FIXTURE ALLOWANCE			OR EQUIVALENT
SC		EXTERIOR WALL MOUNT, BK-150 LAMP	SURFACE WALL	120	75	PROGRESS LIGHTING FIXTURES	LC439628	P56144-31	OR EQUIVALENT
L1		CLOSE TO CEILING, BOWL GLASS, 4 LED BULB	SURFACE CEILING	120	52	PROGRESS LIGHTING FIXTURES		P300814-0XX	OR EQUIVALENT
L2		CLOSE TO CEILING, BOWL GLASS, 2 LED BULB	SURFACE WALL	120	26	PROGRESS LIGHTING FIXTURES		P300814-0XX	OR EQUIVALENT
H		HANGING FIXTURE, LED LAMPS, 6 LED BULB	SURFACE CEILING	120	18	PROGRESS LIGHTING FIXTURES	LC415460	P400918-0XX	OR EQUIVALENT
P		PENDANT FIXTURE, LED LAMPS	SURFACE CEILING	120	18	PROGRESS LIGHTING FIXTURES	L478483	P500029-0XX	OR EQUIVALENT
H		UNDER CABINETS OPTION LED	SURFACE WALL	120	18	PROGRESS LIGHTING FIXTURES	LC516504	P700002-028-30K	OR EQUIVALENT
B		CEILING MOUNTED EXPOSED LED BULB, DAMP LOCATION LISTED	SURFACE CEILING	120	18	PROGRESS LIGHTING FIXTURES	--	--	OR EQUIVALENT

1. ALL BULBS DIMMABLE LED.
2. SPECIFIED LIGHT FIXTURES SHALL BE USED AS A BASIS OF DESIGN. OWNER SHALL APPROVE EXACT LIGHTING FIXTURE PACKAGE PRIOR TO BID SUBMITTAL.
3. RECESSED FIXTURES INSTALLED WITHIN FIRE RATED CEILINGS SHALL BE A UL RATED FIRE RATED HOUSING OR PROVIDED WITH FIRE RATED TENTING ASSEMBLY AROUND PERIMETER OF HOUSING. COORDINATE WITH ARCHITECTURAL FOR RATED CEILING AREAS.

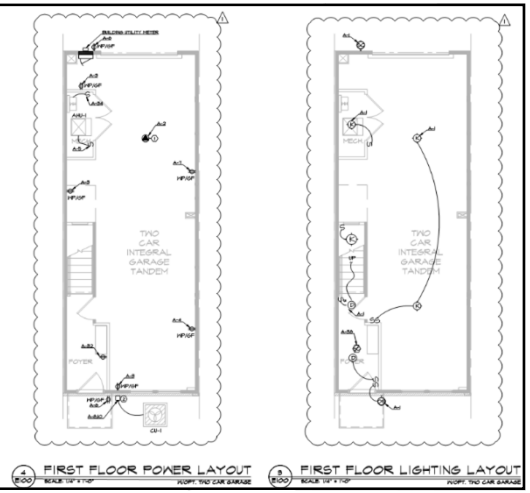
ELECTRICAL PLOT PLAN

- The plot plan shows all outside electrical wiring, including the service entrance.
- This plan is drawn to scale with the exception of the various electrical symbols, which must be enlarged to be readable.
- Transformer location is going to be important for the building reviewer.

ELECTRICAL FLOOR PLANS

Electrical floor plans show the physical locations of all wiring and outlets are shown for lighting, power, signal and communication, special electrical systems, and related electrical equipment.

Equipment and fixtures installed on rated walls are going to be important for the building reviewer.



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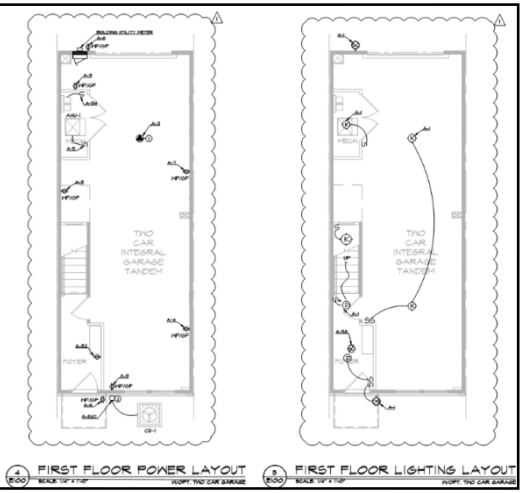
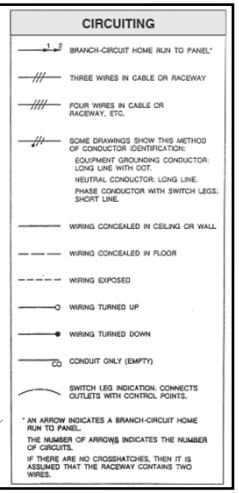


LIGHTING CIRCUITS

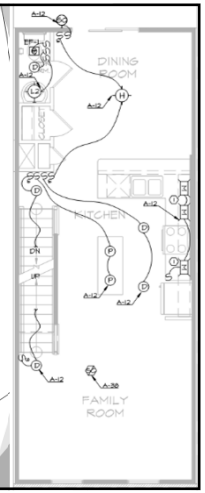
- Lighting circuit electrical floor plan shows light fixtures, emergency lighting, security lighting, and special lighting control.
- Line Examples:
  - Solid for unswitched
  - Dotted for switched
  - Line-dash-line for others like motion sensor circuits.



REFLECTED CEILING PLAN

A reflected ceiling plan shows the lighting, sprinklers, smoke detectors, and any other objects that are located in or on the **ceiling**, such as the mechanical air diffusers and grilles.

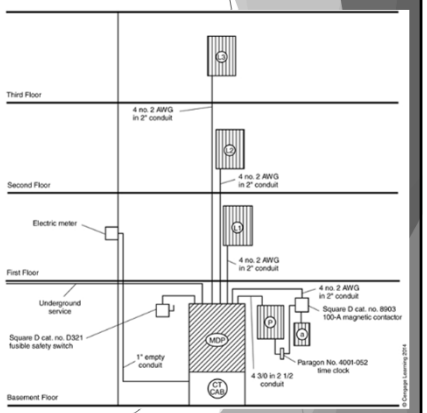
Sprinkler location, exit sign location, rated ceiling fixtures and heavy ceiling mounted equipment are going to be important for the building reviewer.



POWER RISER DIAGRAM

A power riser diagram is a two dimensional drawing that shows the major items of electri cal equipment in a building; disp lays, floor by floor, the feeders and major items of equipment. It doesn't give equipment location.

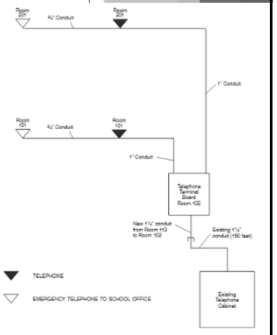
Riser diagram is useful for the building reviewer to quickly identify the electrical equipment used in the building.



POWER RISER DIAGRAM

A riser diagram is used for many systems:

- Fire alarm
- Security
- Telephone
- Clock
- Signals
- Bell, call (nurse, emergency, etc.), water sprinkler



SCHEDULES

A **panel** schedule shows the branch circuits and system loads. They are used to measure the voltages on a **panel**.

Panel load size is important for the building reviewer to determine if panic hardware is required.

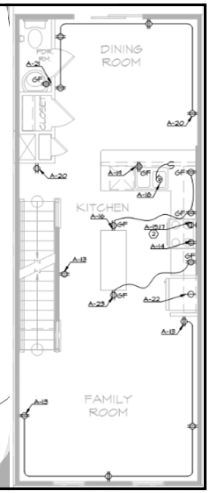
Panel-A

Panel Location:	GARAGE																			
Voltage (Phase-Ground/Phase-Phase)	120	240																		
Phase:	1		Wire-		3															
Rated Amps-	150		AIC-		22k															
MCB-	150		Mounting:		Surface															
Circuit	Description	New/ Existing	Load Type	Breaker Size	Poles	Wire Size	Ground Wire	A	B	A	B	Ground Wire	Wire Size	Poles	Breaker Size	Load Type	New/ Existing	Description	Circuit
1	FIRST FLOOR LIGHTS	N	L	15.0	1	12.0	12.0	0.3		0.5		12.0	12.0	1	20.0	R	N	RECEPTACLE GARAGE DOOR	2
3	RECEPTACLES GARAGE	N	R	20.0	1	12.0	12.0		0.9		0.5	12.0	12.0	1	20.0	R	N	RECEPTACLE CAR CHARGER	4
5	AHU - 1	N	M	15.0	1	12.0	12.0	1.2		0.5		12.0	12.0	1	20.0	R	N	RECEPTACLE OUTDOOR GARAGE	6
7	RECEPTACLE CAR CHARGER	N	R	20.0	1	12.0	12.0		0.5		1.8	12.0	12.0	2	15.0	M	N	CU -1	8
9	CU - 2	N	M	15.0	2	12.0	12.0	1.8		1.8									10
11									1.8		0.7	12.0	12.0	1	15.0	L	N	SECOND FLOOR LIGHTS	12
13	RECEPTACLE FAMILY ROOM	N	R	20.0	1	12.0	12.0	0.9		1.6		12.0	12.0	1	20.0	K	N	MICROWAVE	14
15	RANGE *	N	CK	40.0	2	#8	#8		4.0		0.5	12.0	12.0	1	20.0	R	N	KITCHEN APPLIANCES	16
17								4.0		0.8		12.0	12.0	1	20.0	M	N	DISPOSAL	18
19	DISH WASHER	N	K	20.0	1	12.0	12.0		0.8		0.7	12.0	12.0	1	20.0	R	N	RECEPTACLE DINING ROOM	20
21	RECEPTACLE POWDER ROOM	N	R	20.0	1	12.0	12.0	0.2		1.8		12.0	12.0	1	20.0	M	N	REFRIGERATOR	22
23	KITCHEN APPLIANCES	N	R	20.0	1	12.0	12.0		0.4		1.7	12.0	12.0	1	15.0	L	N	THIRD FLOOR LIGHTS	24
25	RECEPTACLE THIRD FLOOR BATH	N	R	20.0	1	12.0	12.0	0.5		1.1		12.0	12.0	1	20.0	R	N	RECEPTACLE BEDROOM # 2	26
27	RECEPTACLE OWNERS' BEDROOM	N	R	20.0	1	12.0	12.0		1.3		0.4	12.0	12.0	1	15.0	L	N	FOURTH FLOOR LIGHTS	28
29	RECEPTACLE 4TH FLOOR BATH	N	R	20.0	1	12.0	12.0	0.2		1.1		12.0	12.0	1	20.0	R	N	RECEPTACLE LOFT	30
31	AHU - 2	N	M	15.0	1	12.0	12.0		1.2		0.2	12.0	12.0	1	20.0	R	N	RECEPTACLE FOYER	32
33	DRYER	N	M	30.0	2	#8	#8	2.8		0.7		12.0	12.0	1	20.0	WH	N	WATER HEATER	34
35									2.8		1.8	12.0	12.0	1	20.0	M	N	WASHER	36
37	RECEPTACEL BEDROOM # 3	N	R	20.0	1	12.0	12.0	1.1		0.5		12.0	12.0	1	20.0	Misc	N	SMOKE & CARBON MONOXIDE	38
39	SPARE	N	SPARE	20.0	1									1	20.0	Spare	N	SPARE	40
41	SPACE		SPACE													SPACE		SPACE	42
								A	B	Total									
							Connected Load	23.1	22.0	45.1									
							Connected Amps	194.38	182.98	188.68									

NOT:
* IF GAS RANGE IS USED PLEASE CHANGE THE BREAKER SIZE TO 15.0 AMPS.

QUIZ:

Why are circuit lines drawn curved rather than straight?



MECHANICAL & PLUMBING PLANS

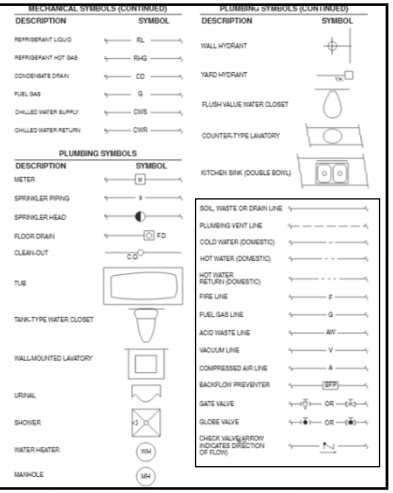
for commercial building reviewers

MECHANICAL SYSTEMS

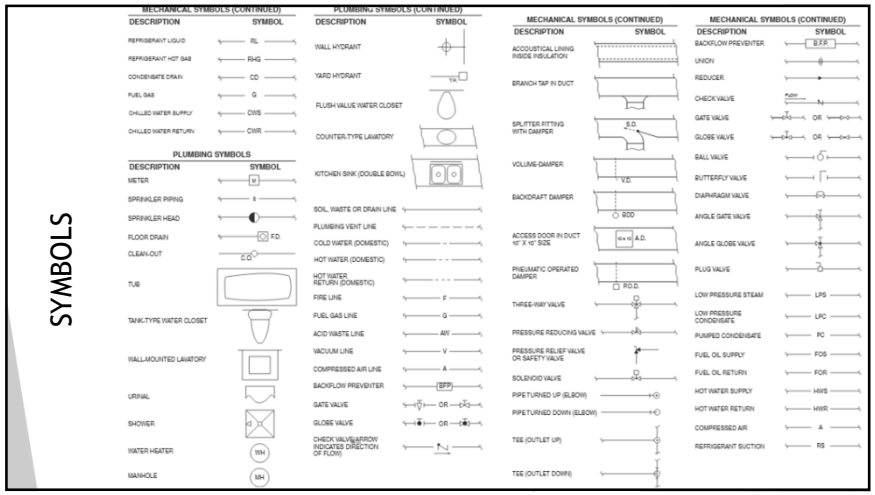
- Residential construction: Heating, ventilating, air conditioning, plumbing are not covered in any depth of drawings for residential construction. Subcontractors do most of the work.
- Commercial construction: Mechanical systems more complex are designed by an engineer. The drawing set will includes drawings for both HVAC and plumbing.

LINES

- A solid line indicates supply pipes.
- A dashed line indicates return pipes.
- Pipe sizes are indicated by callouts.
- Fittings are represented by symbols.
- When pipes need to drop down from the ceiling to the level of the ventilators, they are shown in isometric views.

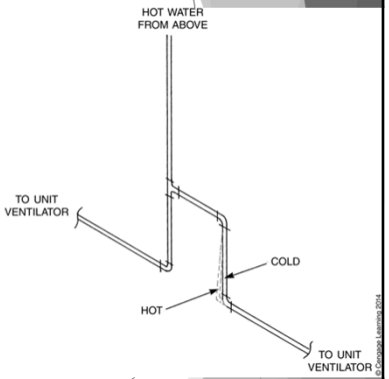


SYMBOLS



ISOMETRIC DRAWINGS

- This isometric drawing shows how the heating pipes drop down from the ceiling to the level of the ventilators.



SCHEDULES

Cabinet unit heaters, unit heaters, and fan cabinet unit heaters are usually described in schedules.

Unit weights are not always shown but very important for the building reviewer.

MARK	MAKE	MODEL	STYLE & ARRANGEMENT	STEAM		WATER				CFM	RPM	EAT	MBH	ELECTRICAL	
				PSIG	LB/HR	EWT	ΔT	GPM	ΔP'					V/φ/HZ	HP
CUH-1	STERLING	RM1-1130-04	RECESSED WALL, INVERTER			180	34	2.0	0.44	420	1050	60	33.8	120/1/60	1/10

CABINET UNIT HEATER SCHEDULE

MARK	MAKE	MODEL	TYPE	WATER			MBH	CFM	EAT	LAT	MOTOR		
				ENT.	GPM	ΔP					RPM	H.P.	V/φ/HZ
UH-1	MODINE	HS-1BL	HORIZONTAL	180	1.1	0.4	9.4	364	60	84	1550	16MP	120/1/60

UNIT HEATER SCHEDULE

MARK	MAKE	MODEL	CFM & TOT.P.A.	EXT. S.P.	ELECTRICAL		HEATING				
					WATTS	VOLTS/PH/HZ	EAT	EWT	GPM	MBH	ΔP
FCU-1	AAF	SFG-1FA-3000	350	0	110	120/1/60	50	180	1.0	18	0.1

FAN COIL UNIT SCHEDULE

Costello, Wiatrek, and Griffith Architects, P.C.

AIR HANDLING EQUIPMENT DESIGNATION

RISER DIAGRAMS

More complex systems for a large building may need a riser diagram.